4 Year B.Tech Program
of
CSE (Data Science)

R-20(*Year 23*) Academic Rules & Regulations
(w.e.f. 2023-2024)

DEPARTMENT OF CSE (DATA SCIENCE)

BAPATLA ENGINEERING COLLEGE :: BAPATLA

(AUTONOMOUS UNDER ACHARYA NAGARJUNA UNIVERSITY)

(SPONSORED BY BAPATLA EDUCATION SOCIETY)

BAPATLA - 522102 GUNTUR DISTRICT, A.P.

www.becbapatla.ac.in

College Vision

To build centres of excellence, impart high quality education and instil high standards of ethics and professionalism through strategic efforts of our dedicated staff, which allows the college to effectively adapt to the ever changing aspects of education.

To empower the faculty and students with the knowledge, skills and innovative thinking to facilitate discovery in numerous existing and yet to be discovered fields of engineering, technology and interdisciplinary endeavours.

College Mission

Our Mission is to impart the quality education at par with global standards to the students from all over India and in particular those from the local and rural areas.

We continuously try to maintain high standards so as to make them technologically competent and ethically strong individuals who shall be able to improve the quality of life and economy of our country.

Department Vision

- To produce Computer Science –Data Science Engineers with Global Standards, who can handle the challenges of developing software services and data related issues of the society & industry, with their innovations and services.

Department Mission

- To impart high quality education with effective teaching and learning process.
- To provide an environment where the students can handle research problems confidently.
- To prepare the students with latest Data Science technologies of the industry.
- To inculcate professional ethics and human values in handling the engineering challenges.

Academic Rules & Regulations
(R20 Regulations)
Regulations for Four Year Bachelor of Technology (B.Tech)
Degree Program for the Batches admitted from the academic year 2020-21
(Academic Regulations as amended in November 2021)

1. Award of B.Tech. Degree

A student will be declared eligible for the award of the B.Tech. degree if he/she fulfils the following academic regulations:

- **i.** Pursues a course of study for not less than four academic years and in not more than eight academic years. However, for the students availing Gap year facility, this period shall be extended by two years at the most and these two years would not be counted in the maximum time permitted for graduation. A lateral entry student pursues a course of study for not less than three academic years and in not more than six academic years.
- **ii.** Registers for 160 credits and secures all 160 credits. However, a lateral entry student registers for 121 credits and secures all the 121 credits from III semester to VIII semester of Regular B. Tech. program.
- **iii.** The student will be eligible to get under graduate degree with Honors or additional minor engineering if he/she completes an additional 20 credits.
- **iv.** A student will be permitted to register either for Honors degree or additional minor engineering but not both.

2. Students, who fail to fulfil all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. course and their admission stands cancelled. A lateral entry student should complete the course within six academic years from the year of their admission, failing which his/her admission in B.Tech course stands cancelled.

3. Courses of study

The following courses of study are offered at present as specializations for the B. Tech. course.

S.No.	Title of the UG Programme	Abbreviation
1.	Civil Engineering	CE
2.	Computer Science & Engineering	CS
3.	Electrical & Electronics Engineering	EE
4.	Electronics & Communication Engineering	EC
5.	Electronics & Instrumentation Engineering	EI
6.	Information Technology	IT
7.	Mechanical Engineering	ME
8.	Cyber Security	CS
9.	Data Science	DS
10.	CSE (Artificial Intelligence & Machine Learning	CM

4. Credits:

i. *Credit:* A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (Lecture) or two hours of practical work/field work per week.

ii. *Academic Year:* Two consecutive (one odd + one even) semesters constitute one academic year.

iii. *Choice Based Credit System (CBCS):* The CBCS provides choice for students to select from the prescribed courses.

iv. Each course in a semester is assigned certain number of credits based on following:

Description	**Hours/Week**	**Credits**
Theory	03	03
Tutorial	01	01
Practical	03	1.5
Internship (At the end of IV & VI evaluated in V & VII resp.)	-	1.5/3.0
Project Work	24	12

5. Course Structure

Every course of the B.Tech program will be placed in one of the 8 categories with suggested credits as listed below.

S.No.	**Category**	**Category Description**	**Abbreviated Category**	**Credits**
1	Humanities and social science	Humanities and social science including Management courses	HS	10.5
2	Basic Sciences	Basic Science courses	BS	21
3	Engineering Science courses	Engineering Science Courses including workshop, drawing, basics of electrical / mechanical / computer etc.	ES	24
4	Professional core	Professional core Courses	PC	51
5	Job Oriented /Open Electives	Emerging and job oriented/ Open Elective Courses- from other technical	JO/OE	12
6	Professional Courses	Professional Elective Courses relevant to chosen specialization/ branch	PE	18
7	Project Work & Internship	Project Work, Seminar, Internship in industry elsewhere	PW/INT	16.5
8	Mandatory courses	Environmental Studies, Induction training, Universal human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge (Non-Credit)	MC	0
9	Skill Oriented Courses	Skill Oriented Courses relevant to domain, interdisciplinary, communication skill, industry	SO	10
Total Credits				**160**

6. Weightage for Course Evaluation

6.1 Course Pattern

1. The entire course of study is for four academic years. Semester pattern shall be followed in all years.
2. A student eligible to appear for the end examination in a subject, but absent or has failed in the end examination may appear for that subject at the next supplementary examination when offered.
3. When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

6.2 Evaluation Process

The performance of the students in each semester shall be assessed course wise. All assessments will be done on absolute mark basis. However, for the purpose of reporting the performance of a candidate, letter grades and grade points will be awarded.

The performance of a student in each course is assessed with alternate assessment methods, term examinations on a continuous basis during the semester called Continuous Internal Evaluation (CIE) and a Semester End Examination (SEE) conducted at the end of the semester. For each theory, design and/or drawing course, there shall be a comprehensive Semester End Examination (SEE) of three hours duration at the end of each Semester, except where stated otherwise in the detailed Scheme of Instruction.

The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory and 100 marks for practical subject. In addition, Internships carried out after IV Semester & VI Semester shall be evaluated for 100 marks each and the Internship along with Project Work carried out in VIII Semester shall be evaluated for 100 marks. For theory subjects, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination. For practical subjects, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination. For project work, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination / Viva-Voce. The distribution of marks between Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) to be conducted at the end of the semester will be as follows:

Nature of the Course	CIE	SEE
Theory subjects	30	70
Practical	30	70
Summer / Industrial / Research Internship	-	100
Project Work	30	70

6.3 Continuous Internal Evaluation (CIE) in Theory subjects:

6.3.1 In each Semester there shall be two Term examinations and some ***Alternate Assessment Tools (AAT)*** like Home Assignment, Class Test, Problem Solving, Group Discussion, Quiz, Seminar and Field Study in every theory course. The Alternate Assessment Tools with detailed modality of evaluation for each course shall be finalized by the teacher concerned before beginning of the course. It will be reviewed and approved by the Department Committee.

The Term Examination is conducted in the regular mode according to a schedule which will be common for a particular year of study. The maximum weightage for Term Examinations, AATs and the calculation of marks for CIE in a theory course is given in the following Table.

Particulars	**Term Exams (Max. 20 marks)**	**AAT (Max. 10 marks)**
Better Performed exam	75% of marks obtained	Continuous assessment by teacher as per the predetermined course delivery & assessment plan. (Minimum two & maximum four assessments). AAT marks shall be considered based on average of all tests conducted.
Other exam	25% of marks obtained	

A minimum of 15 (50%) marks are to be secured exclusively in the Continuous Internal Evaluation (CIE) in order to be declared as qualified in that course and eligible to write the Semester End Examination (SEE) of that course. If a student fails to obtain 15 marks in CIE, he can register for the course repetition as per the guidelines mentioned in 6.5.

Make up Test:

a) A student can appear for a Make-up Test for **maximum two theory subjects** of a semester to improve marks in the Continuous Internal Evaluation (CIE).

b) A student is eligible for **Make-up test** which is conducted after the second Mid Term examination and before SEE examination if he/she satisfies the following conditions.
   i) Unable to secure 50% internal marks (CIE) and has more than or equal to 50% attendance in a particular theory subject (After finalizing the internal marks).
   ii) Attendance in Remedial classes is more than or equal to 65% (if Remedial classes are conducted) or greater than 50% marks in the I Mid Term Examination and AAT 1 together.
   iii) Attended 50% of CIE tests (at least one AAT & one Mid Term Examinations).

c) The make-up test will be conducted for 30 marks (6 X 1M, 2X 12M) in Mid Examination format covering the entire syllabus and the marks obtained in this test are final. However, the maximum marks awarded will be 15 only.

6.3.2 Semester End Examination (SEE) in Theory and Design Course:

a) For each theory, design and/or drawing course, there shall be a comprehensive Semester End Examination (SEE) of three hours duration at the end of each Semester for 70 marks, except where stated otherwise in the detailed Scheme of Instruction. Question paper setting shall be set by the teacher or teachers together in a multi section courses and to be verified as described in policy document.

b) A minimum of 25 marks are to be secured exclusively in the Semester End Examination (SEE) of theory, design and/or drawing course. However a minimum 40 marks are to be secured in CIE & SEE together for the award of the grade and securing the credits in that course.

6.3.3 Continuous Internal Evaluation (CIE) in laboratory courses:

The evaluation for Laboratory course is based on CIE and SEE. The CIE for 30 marks comprises of 15 marks for day to day laboratory work, 5 marks for record submission and 10 marks for a laboratory examination at the end of the semester. In any semester, a minimum of 90% of prescribed number of experiments / exercises specified in the syllabi for laboratory course shall be taken up by the students. They shall complete these experiments / exercises in all respects and get the record certified by the internal lab teacher concerned and the Head of the Department concerned to be eligible to appear for the Final Examination in that laboratory course.

A minimum of 15 (50%) marks are to be secured exclusively in the Continuous Internal Evaluation (CIE) in order to be declared as qualified in that lab course and eligible to write the SEE of that lab course. If a student fails to obtain 15 marks in CIE, he can register for the course repetition as per the guidelines mentioned in 6.5.

6.3.4 Semester End Examination (SEE) in laboratory courses:

a) For each laboratory course, the Semester End Examination (SEE) shall be conducted by one internal and one external examiner appointed by the Principal and the duration of the exam shall be for three hours. The SEE is for 70 marks which include 15 marks for write up, 35 marks for lab experiment/exercise, 15 marks for Viva-voce and 5 marks for general impression.

b) A minimum of 25 marks are to be secured exclusively in the Semester End Examination (SEE) of laboratory course. However a minimum 40 marks are to be secured in CIE & SEE together for the award of the grade and securing the credits in that course.

6.3.5 Evaluation of Summer Internship and Industrial/Research Internship:

a) Summer Internship at the end of IV semester and Industrial/Research Internship at the end of VI carried out in industry are to be evaluated in V & VII semesters respectively based report and certificate provided by the industry. The report and certificate will be evaluated by the department committee for 100 marks. 50 marks shall be for the report and certificate and 50 marks based on seminars/presentation to the department committee by the student.

b) A minimum of 40 (40%) marks are to be secured exclusively to be declared as passed and securing the credits in the internships.

6.3.6 Evaluation of the Project

a) The evaluation shall be based on CIE and SEE. The CIE is for 30 marks which consists of reviews at the end of each month as per the Process Document in the form of seminars/presentations for 15 marks and the project report submitted at the end of the semester which is evaluated for 15 marks. A minimum of 15 (50%) marks and 50% attendance are to be secured by the student exclusively in CIE in order to be declared as qualified in the project work and eligible to write the SEE in the project work.

b) SEE shall be evaluated in the form of a Viva-Voce and demonstration of the thesis work for 70 marks. Viva-voce Examination in project work shall be conducted by one internal examiner (Member of PWC) and one external examiner to be appointed by the principal. A minimum of 25 marks shall be obtained exclusively in SEE in order to be declared as passed in the Project work.

c) Completion of internships along with Project work in VIII Semester is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student has to repeat and complete the internship.

6.4 There shall be mandatory courses with zero credits. There shall be no external examination. However, attendance in the mandatory course shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 50% or more in the internal examinations. In case, the student fails, a re-examination shall be conducted for failed candidates every six months/semester at a mutually convenient date of college/student satisfying the conditions mentioned in item 1 & 2 of the regulations.

6.5 Course Repetition (Repeater course)

The students not qualified to write SEE in a course may register for the repeater courses through course repetition and summer semester. The students have to apply to the Principal through the respective HOD by paying prescribed fees.

Course repetition: A student can take up a maximum of two theory courses in a semester immediately after the semester end examinations of that particular semester in accordance with the guidelines recommended by the Academic Council. The students who are not taking regular semester courses may additionally register for one more theory course.

The documents for monitoring the candidates registered for course repetition are available with the Heads of the Departments and Exam Section.

6.6 There shall be five Professional Elective Courses from V Semester to VII and for each elective there shall be choices such that the student shall choose a course from the list of choice courses offered by the department for that particular elective.

6.7 There shall be three Job Oriented elective Courses in all programs from V to VII semester.

One Open Elective course in VII semester will be offered by various departments. The student shall register for open elective in the VII semester offered by other departments in such a manner that he/she has not studied the same course in any form during the Program.

The students shall be permitted to pursue up to a maximum of two elective courses (either Professional Elective Courses in clause 6.6 or Open Electives/ Job Oriented Courses in clause 6.7) under MOOCs (Massive Open Online Courses) offered by NPTEL and other reputed organizations as notified by the Department during the semester. Each of the Courses must be of minimum 8/12 weeks in duration. The student has to acquire a certificate for the concerned course from the agency during the semester only in order to earn the credits for that course. For further details and guidelines, the students can visit the college website.

6.8 There shall be a mandatory **induction program** for three weeks before the commencement of first semester.

6.9 Minor in a discipline (Minor degree/program) concept is introduced in the curriculum for all conventional B. Tech programs in which it offers a major. The main objective of Minor in a discipline is to provide additional learning opportunities for academically motivated students and it is an optional feature of the B. Tech. program.

a. i) Students who are desirous of pursuing their special interest areas other than the chosen discipline of Engineering may opt for additional courses in minor specialization groups offered by a department other than their parent department. For example, If Mechanical Engineering student selects subjects from Civil Engineering under this scheme, he/she will get Major degree of Mechanical Engineering with minor degree of Civil Engineering

   ii) Student can also opt for Industry relevant tracks of any branch to obtain the Minor Degree, for example, a B.Tech Mechanical student can opt for the industry relevant tracks like Data Mining track, IOT track, Machine learning track etc.

b. The BOS concerned shall identify as many tracks as possible in the areas of emerging technologies and industrial relevance / demand. For example, the minor tracks can be the fundamental courses in CSE, ECE, EEE, CE, ME etc or industry

tracks such as Artificial Intelligence (AI), Machine Learning (ML), Data Science (DS), Robotics, Electric vehicles, Robotics, VLSI etc.

c. The list of disciplines/branches eligible to opt for a particular industry relevant minor specialization shall be clearly mentioned by the respective BOS.
d. There shall be no limit on the number of programs offered under Minor. The University/Institution can offer minor programs in emerging technologies based on expertise in the respective departments or can explore the possibility of collaborating with the relevant industries/agencies in offering the program.
e. The concerned BOS shall decide on the minimum enrolments for offering Minor program by the department. If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BOS.
f. A student shall be permitted to register for Minor program at the beginning of 4^{th} semester provided that the student must have acquired a minimum of **8.0 SGPA** in each semester up to the end of 2^{nd} semester without any backlogs. In case of the declaration of the 3^{rd} semester results after the commencement of the 4^{th} semester and if a student fails to score the required minimum of 8 SGPA, his/her registration for Minor Program stands cancelled and he/she shall continue with the regular Program. An SGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Minor registration active
g. A student shall earn additional 20 credits in the specified area to be eligible for the award of B. Tech degree with Minor. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).
h. Out of the 20 Credits, 16 credits shall be earned by undergoing specified courses listed by the concerned BOS along with prerequisites. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. If a course comes with a lab component, that component has to be cleared separately. A student shall be permitted to choose only those courses that he/she has not studied in any form during the Program.
i. In addition to the 16 credits, students must pursue at least 2 courses through MOOCs. The courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned as decided by the university/academic council.
j. Student can opt for the Industry relevant minor specialization as approved by the concerned departmental BOS. Student can opt the courses from Skill Development Corporation (APSSDC) or can opt the courses from an external agency recommended and approved by concerned BOS and should produce course completion certificate. The Board of studies of the concerned discipline of Engineering shall review such courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest skills based on industrial demand.
k. A committee should be formed at the level of College/Universities/department to evaluate the grades/marks given by external agencies to a student which are approved by concerned BOS. Upon completion of courses the departmental committee should convert the obtained grades/marks to the maximum marks assigned to that course. The controller of examinations can take a decision on such conversions and may give appropriate grades.
l. If a student drops (or terminated) from the Minor program, they cannot convert the

earned credits into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.

m. In case a student fails to meet the CGPA requirement for B.Tech degree with Minor at any point after registration, he/she will be dropped from the list of students eligible for degree with Minors and they will receive B. Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.
n. Minor must be completed simultaneously with a major degree program. A student cannot earn the Minor after he/she has already earned bachelor's degree.
o. Minimum enrollment for a Minor course to be offered is 12.

6.10 Honors degree in a discipline: Students of a Department/Discipline are eligible to opt for Honors Program offered by the same Department/Discipline.

a. A student shall be permitted to register for Honors program at the beginning of 4^{th} semester provided that the student must have acquired a minimum of **8.0 SGPA** in each semester up to the end of 2^{nd} semester without any backlogs. In case of the declaration of the 3^{rd} semester results after the commencement of the 4^{th} semester and if a student fails to score the required minimum of 8 SGPA, his/her registration for Honors Program stands cancelled and he/she shall continue with the regular Program. An SGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Honors registration active.
b. Students can select the additional and advanced courses from their respective branch in which they are pursuing the degree and get an honors degree in the same. e.g. If a Mechanical Engineering student completes the selected advanced courses from same branch under this scheme, he/she will be awarded B.Tech. (Honors) in Mechanical Engineering.
c. In addition to fulfilling all the requisites of a Regular B.Tech Program, a student shall earn 20 additional credits to be eligible for the award of B. Tech (Honors) degree. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).
d. Of the 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses listed as pools, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two MOOCs, which shall be domain specific, each with 2 credits and with a minimum duration of 8/12weeks as recommended by the Board of studies.
e. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. The courses offered in each pool shall be domain specific courses and advanced courses.
f. The concerned BOS shall decide on the minimum enrolments for offering Honors program by the department. If minimum enrolments criteria are not met then the students shall be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BOS.
g. Each pool can have theory as well as laboratory courses. If a course comes with a lab component, that component has to be cleared separately. The concerned BOS shall explore the possibility of introducing virtual labs for such courses with lab component. (Model pool list is enclosed in the Annexure-2).

h. MOOC courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Students have to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned will be as decided by the BOS/academic council.
i. The concerned BOS shall also consider courses listed under professional electives of the respective B. Tech programs for the requirements of B. Tech (Honors). However, a student shall be permitted to choose only those courses that he/she has not studied in any form during the Program.
j. If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.
k. In case a student fails to meet the CGPA requirement for Degree with Honors at any point after registration, he/she will be dropped from the list of students eligible for Degree with Honors and they will receive regular B.Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.
l. Honors must be completed simultaneously with a major degree program. A student cannot earn Honors after he/she has already earned bachelor's degree.

6.11 National Service Scheme (NSS)/Yoga is compulsory for all the Undergraduate students. The student participation shall be for a minimum period of 45 hours during the first year. Grades will be awarded as Very Good, Good, Satisfactory in the mark sheet on the basis of participation, attendance, performance and behaviour. If a student gets Un-satisfactory grade, he/she has to repeat the above activity in the subsequent years along with the next year students.

6.12 Students shall undergo two summer internships each for a minimum of six weeks duration at the end of second and third years of the program for 1.5 credits & 3 credits respectively. The organization in which the student wishes to carry out Internship need to be approved by Internal Department Committee comprising Head of Department and two senior faculty members. The student shall submit a detailed technical report along with internship certificate from the Internship organization in order to obtain the prescribed credits. The student shall submit the Internship Report along with Certificate of Internship. The evaluation of the first and second summer internships shall be conducted at the end of the V Semester & VII semester respectively.

There shall be internal evaluation for 100 marks and there shall not be external evaluation. The Internal Evaluation shall be made by the departmental committee (Head of the Department and two senior faculty of the department) on the basis of the internship report submitted by the student.

Completion of the internship is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such a case, the student shall repeat the internship in the subsequent summer provided that the student doesn't pursue two summer internships in the same summer.

Community Service Project focussing on specific local issues shall be an alternative to the six weeks of summer Internship, whenever there is any emergency and when students cannot pursue their summer internships. The Community Service Project shall be for 6 weeks in duration which includes preliminary survey for 1 week, community awareness programs for one week, community immersion program in consonance with Government agencies for 3 weeks and a community exit report (a detailed report) for one week. The community service project shall be evaluated for 100 marks by the internal departmental committee comprising Head of the Department and two senior faculty of the department. **However, the first priority shall be given to the internship.**

6.13 There shall also be a mandatory full internship in the final semester (VIII Semester) of the Program along with the project work. The organization in which the student wishes to carry out the Internship need to be approved by Internal Department Committee comprising Head of the Department and two senior faculty. The faculty of the respective department monitors the student internship program along with project work. At the end of the semester, the candidate shall submit a certificate of internship and a project report. The project report and presentation shall be internally evaluated for 30 marks by the departmental project work committee. The Viva-Voce shall be conducted for 70 marks by a Project work committee and an External Examiner.
Completion of internship is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such a case, the student shall repeat the internship along with project work for next six months.

6.14 There shall be five skill-oriented courses offered during III semester to VII semester. Out of the five skill courses, two shall be skill-oriented programs related to the domain and these two shall be completed in second year. Of the remaining three skill courses, one shall necessarily be a soft skill course and the remaining 2 shall be skill-advanced courses either from the same domain or Job oriented skill courses, which can be of inter disciplinary nature.
The student can choose between a skill advanced course being offered by the college or to choose a certificate course being offered by industries/Professional bodies/APSSDC or any other accredited bodies which are duly approved by the Internal Department Committee. The credits assigned to the skill advanced course shall be awarded to the student upon producing the Course Completion Certificate from the agencies / professional bodies.
The Internal Department Committee comprising Head of Department and two senior faculty shall evaluate the grades / marks awarded for a course by external agencies and convert to the equivalent marks / grades.

7. Attendance Requirements:

- A student shall be eligible to appear for semester end examinations (SEE), if he/she acquires a minimum of 75% of attendance in aggregate of all the subjects in a semester.
- Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted on medical ground duly approved by the Principal.
- Shortage of Attendance below 65% in aggregate shall in NO case be condoned.
- Further the student must obtain a minimum of 50% attendance in each subject failing which; the student shall not be permitted to write the SEE of that subject.

Student has to register this subject through course repetition and satisfy the CIE qualification criteria of attendance and marks in the subsequent semesters.

- Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.
- A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester when offered next.
- A stipulated fee shall be payable towards condonation of shortage of attendance to the college.

8. Minimum Academic Requirements:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.7.

8.1 A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project, if he/she secures not less than 15 marks in CIE and 25 marks in SEE. In case of, internships, project work viva – voce, he/she should secure 40% of the total marks. For mandatory courses minimum 15 marks in CIE are to be secured.

8.2 B.Tech students: A student shall be promoted from II to III year only if he/she fulfils the academic requirement of securing 40% of the credits in the subjects that have been studied up to III Semester from the following examinations.

- One regular and two supplementary examinations of I Semester.
- One regular and one supplementary examination of II Semester.
- One regular examination of III semester.

Lateral Entry students: A student shall be promoted from II to III year only if he/she fulfils the academic requirement of securing 40% of the credits in the subjects that have been studied up to III Semester from the following examinations.

- One regular examination of III semester.

8.3 B.Tech students: A student shall be promoted from III year to IV year only if he/she fulfils the academic requirements of securing 40% of the credits in the subjects that have been studied up to V semester from the following examinations, irrespective of whether the candidate takes the end examination or not as per the normal course of study.

- ✓ One regular and four supplementary examinations of I Semester.
- ✓ One regular and three supplementary examinations of II Semester.
- ✓ One regular and two supplementary examinations of III Semester.
- ✓ One regular and one supplementary examinations of IV Semester.
- ✓ One regular examination of V Semester.

Lateral entry students: A student shall be promoted from III year to IV year only if he/she fulfils the academic requirements of securing 40% of the credits in the subjects that have been studied up to V semester from the following examinations, irrespective of whether the candidate takes the end examination or not as per the normal course of study.

- ✓ One regular and two supplementary examinations of III Semester.
- ✓ One regular and one supplementary examinations of IV Semester.
- ✓ One regular examination of V Semester.

If a student is detained for want of credits for particular academic year by sections 8.2 and 8.3 above, the student may make up the credits through supplementary

examinations and only after securing the required credits he/she shall be permitted to join in the V Semester or VII Semester as the case may be.

8.4 A student shall register and put up minimum attendance in all 160 credits and earn all the 160 credits. Marks obtained in all 160 credits shall be considered for the calculation of aggregate percentage of marks obtained. In case of lateral entry students, the number of credits is 121.

8.4.1 Students who fail to earn 160 credits as indicated in the course structure within eight academic years from the year of their admission shall forfeit their seat in B.Tech. course and their admission shall stand cancelled.

Lateral entry students who fail to earn 121 credits as indicated in the course structure within six academic years from the year of their admission shall forfeit their seat in B.Tech. course and their admission shall stand cancelled.

9. Course Pattern:

(i) A student eligible to appear for the end examination in a subject, but absent or has failed in the end examination may appear for that subject at the next supplementary examination when offered.

When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

(ii) **With–holding of Results**

If any case of indiscipline or malpractice is pending against candidate, the result of the candidate shall be with held and he/she will not be allowed/promoted into the next higher semester. The issue of awarding degree is liable to be withheld in such cases.

(iii) **Grading**

After each subject is evaluated for 100 marks, the marks obtained in each subject will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Table – Conversion into Grades and Grade Points assigned

Range in which the marks in the subject fall	Grade	Grade Points Assigned
≥ 90	S (Superior)	10
80-89	A (Excellent)	9
70-79	B (Very Good)	8
60-69	C (Good)	7
50-59	D (Average)	6
40-49	E (Below Average)	5
< 40	F (Fail)	0
Absent	Ab (Absent)	0

A student obtaining Grade F shall be considered failed and will be required to reappear for that subject when the next supplementary examination offered. Same is the case with a student who obtains ‘Ab’ in end examination.

For **mandatory** courses “Satisfactory” or “Unsatisfactory” shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA

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10. Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)

(i) The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.,

$$\text{SGPA} = \frac{\sum_{i=1}^{n} C_i \times GP_i}{\sum_{i=1}^{n} C_i}$$

where, C_i is the number of credits of the i^{th} subject and GP_i is the grade point scored by the student in the i^{th} course.

(ii) The Cumulative Grade Point Average (CGPA) will be computed in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.,

$$\text{CGPA} = \frac{\sum_{j=1}^{m} SGPA_j \times TC_j}{\sum_{j=1}^{m} TC_j}$$

where "$SGPA_j$" is the SGPA of the j^{th} semester and TC_j is the total number of credits in that semester.

(iii) Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

(iv) While computing the SGPA, the subjects in which the student is awarded Zero grade points will also be included.

(v) Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.

(vi) Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters S, A, B, C, D, E and F

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11. Award of Class

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. degree, he/she shall be placed in one of the following four classes.

Class Awarded	**CGPA Secured**
First Class with Distinction	≥ 7.5
First Class	$\geq 6.5 < 7.5$
Second Class	$\geq 5.5 < 6.5$
Pass Class	$\geq 5.0 < 5.5$

12. Gap Year

Gap year concept of Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after II year to pursue entrepreneurship full time. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. An evaluation committee shall be constituted by the College to evaluate the proposal submitted by the student and the committee shall decide whether or not to permit the student(s) to avail the Gap Year.

13. Transitory Regulations

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, and they will be in the academic regulations into which they get readmitted.

Candidates who were permitted with Gap Year shall be eligible for rejoining into the succeeding year of their B.Tech from the date of commencement of class work, and they will be in the academic regulations into which the candidate is presently re-joining.

14. Minimum Instruction Days

The minimum instruction days including exams for each semester shall be 90 days.

15. Medium of Instruction

The Medium of Instruction is **English** for all courses, laboratories, internal and external examinations and project reports.

16. Rules of Discipline

(i) Use of mobile phones with camera, in the campus is strictly prohibited.

(ii) Students shall behave and conduct themselves in a dignified and courteous manner in the campus/Hostels.

(iii) Students shall not bring outsiders to the institution or hostels.

(iv) Students shall not steal, deface, damage or cause any loss to the institution property.

(v) Students shall not collect money either by request or coercion from others within the campus or hostels.

(vi) Students shall not resort to plagiarism of any nature/extent. Use of material, ideas, figures, code or data without appropriate acknowledgement or permission of the original source shall be treated as cases of plagiarism. Submission of material, verbatim or paraphrased, that is authored by another person or published earlier by oneself shall also be considered as cases of plagiarism.

(vii) Use of vehicles by the students inside the campus is prohibited.

(viii) Any conduct which leads to lowering of the esteem of the organization is prohibited.

(ix) Any material to be uploaded to social media sites need to be approved by Head of the Department concerned/Dean/Principal.

(x) Any student exhibiting prohibited behaviour shall be suspended from the institute. The period of suspension and punishment shall be clearly communicated to the student. The student shall lose the attendance for the suspended period.

(xi) Dress Code

Boys: All the boy students should wear formal dresses. Wearing T-shirts and other informal dresses in the campus is strictly prohibited.

Girls: All the girls students shall wear saree / chudidhar with dupatta.

17. Punishments for Malpractice cases – Guidelines

The examinations committee may take the following guidelines into consideration while dealing with the suspected cases of malpractice reported by the invigilators/squad members etc; during end examinations. The punishment may be more severe or less severe depending on the merits of the individual cases.

S.No.	Nature of Malpractice/ Improper conduct	Punishment
1	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cellphones, pager, palm computers or any other form of material concerned with or related to the course of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the course of the examination).	Expulsion from the examination hall and cancellation of the performance in that course only.
2	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that course.
3	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that semester/year examinations.
4	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any other student or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that course only of all the students involved. In case of an outsider, he will be handed over to the police and a case shall be registered against him.
5	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the course of the examination (theory or practical) in which the student is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses including practical examinations and project work of that semester/year.
6	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses including practical examinations and project work of that semester/year.
7	Smuggles in the Answer book or takes out or arranges to send out the question paper during the examination or answer book during or after the examination	Expulsion from the examination hall and cancellation of performance in that course and all the other courses including practical examinations and project work of that

		semester/year. The student is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeit of seat.
8	Refuses to obey the orders of the Chief Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses of that semester/year. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case shall be registered against them.
9	Leaves the exam hall taking away answer script or intentionally tears up the script or any part there of inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses including practical examinations and project work of that semester/year. The candidate is also debarred for two consecutive semesters from classwork and all end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
10	Possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses including practical examinations and project work of that semester/year. The student is also debarred and forfeits the seat.
11	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any	For Student of the college: Expulsion from the examination hall and cancellation of the performance in that course and all other courses including practical examinations and project

	malpractice or improper conduct mentioned in S.No7 to S.No 9.	work of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case shall be registered against them.
12	Impersonates any other student in connection with the examination	The student who has impersonated shall be expelled from examination hall. The student is debarred from writing the remaining exams, and rusticated from the college for one academic year during which period the student will not be permitted to write any exam. If the imposter is an outsider, he will be handed over to the police and a case shall be registered against him. The performance of the original student, who has been impersonated, shall be cancelled in all the courses of the examination including practicals and project work of that semester/year. The student is rusticated from the college for two consecutive years during which period the student will not be permitted to write any exam. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
13	If any malpractice is detected which is not covered in the above S.No 1 to S.No 12 items, it shall be reported to the college academic council for further action and award suitable punishment.	
14	Malpractice cases identified during sessional examinations will be reported to the examination committee nominated by Academic council to award suitable punishment.	

18. ADDITIONAL ACADEMIC REGULATIONS:

(i) Any attempt to impress upon the teachers, examiners, faculty and staff of Examinations, bribing for either marks or attendance will be treated as malpractice.

(ii) When a component of Continuous Internal Evaluation (CIE) or Semester End Examination (SEE) is cancelled as a penalty, he/she is awarded zero marks in that component.

19. AMENDMENTS TO REGULATIONS:

The Academic Council of Bapatla Engineering College (Autonomous) reserves the right to revise, amend, change or nullify the Regulations, Schemes of Examinations and / or Syllabi, Academic schedules, Examination schedules, Examination pattern, Moderation to students, Special opportunity to complete degree beyond stipulated time and any other matter pertained that meets to the needs of the students, society and industry without any notice and the decision is final.

Discipline and Code of Conduct for Students

The following are some of the important rules of discipline. All students are required to be aware of and act consistently with these values.

1. Students must punctually attend all lectures, practicals, tutorials, assignments, tests, examinations, etc. A student whose attendance and/or progress in the various tests and examinations are not satisfactory and who does not perform the required number of assignments, tutorials and/or practicals are likely to lose their terms. Prolonged absence even on ground of ill health may also lead to loss of terms. Defaulters will not be sent up for Final /University Examinations.
2. The identity card is meant for identifying bonafide students and is used for permitting the students to participate in various activities and programs of the college. Every student must wear Identity card as long as he/she is in the college campus. It must be produced by the student whenever demanded by the member of the teaching or non-teaching staff of the college. Every student must wear his/her Identity card in the college every day. He/She must take proper care of it to avoid its misuse by other students and outsiders. In case the Identity card is lost, the matter should be immediately reported to the Principal and an application should be made for a duplicate Identity card, which will be issued on payment of charges.
3. The conduct of the students in the classes and in the premises of the college shall be such as will cause no disturbance to teachers, fellow students or other classes.
4. Every student shall wear a clean formal dress while coming to the college also when representing the college for various activities out station.
5. No Society or Association shall be formed in the College and no person should be invited in the college campus without the specific permission of the Principal.
6. No student is allowed to display any Notice/Circular/Poster/Banner in the College premises without the prior permission of the Principal.
7. Using foul languagein the college campus is prohibited. If any student is caught using foul language, disciplinary action shall be initiated against the student.
8. Use of **BEC name tag or logo** by the students for their caste, political, religious, personal reasons is prohibited. Further placing banners on caste, political, religious, personal reasons, promoting cinema heroes & political leaders, taking possessions and burning fire crackersin front of the collegeis strictly prohibited. If any student is involved in such activities in and around the campus, severe disciplinary action will be taken including rusticating from the college and filing a criminal case.
9. Outsiders are not permitted in the college premises without the prior permission of the Principal. College students are not allowed to bring their relatives/friends to the college premises without the permission of the principal.
10. All meetings, cultural programs, debates, elocutions etc. organized on the college premises must be held in presence of teaching staff members and with the prior permission of the Principal. The subjects of debates/elocutions must have the prior approval of the principal.
11. Conducting fresher's meet, farewell meets etc. by the students outside the campus are prohibited. If any student is involved in such activities (organizing as well as participating), severe disciplinary action will be taken including rusticating from the college.
12. Students must take proper care of the college property. Strict action will be taken against students damaging College property and will be required to compensate the damage.
13. Students should not be involved in academic offences including cheating or plagiarism in academic course work malpractices at the College/Board/University Examinations

14. Smoking is strictly prohibited in the college premises.
15. If, for any reason, the continuance of a student in the College is found detrimental to the best interest of the college, the Management may ask the student to leave the college without assigning any reasons and the decision will be final and binding on the student.
16. Playing music on Transistors, Tape-Recorders, Car Stereos, Mobile phones or any other similar gadgets with or without earphones is strictly prohibited in the college premises. Defaulters will be punished and their instrument shall be confiscated.
17. Use of Mobile phones is strictly prohibited in the academic area of the college, Defaulters will be penalized and their instrument confiscated.
18. Students who are travelling to college on personal vehicles (2/4 wheelers) need to have valid driving license issued by RTO and follow all the rules listed by RTO. Students have to park the vehicle in the parking area of the college.
19. Students must not hang around in the college premises while the classes are at work.
20. Students must not attend classes other than their own without the permission of the authority concerned.
21. Students shall do nothing inside or outside the college that will interface with the discipline of the college or tarnish the image of the college.
22. Students are not allowed to communicate any information about college matters to Press.
23. Matters not covered above will be decided at the discretion of the Principal.

Acts of misbehavior, misconduct, indiscipline or violation of the Rules of Discipline mentioned above liable for one more punishments as stated below:

A. Warning to the students.
B. Warning to the student as well as inform the parents.
C. Imposition of a fine.
D. Denial of gymkhana, library, laboratory, N.C.C., N.S.S. student aid or any other facility for a specified period or for the whole Term/Year.
E. Expulsion from College for a specified period
F. Cancellation of Terms.
G. Refusal of admission in the term or academic year.
H. Cancellation of admission.
I. Rustication.

Anti-Ragging Rules and Regulations
(As per AICTE Norms)

What constitutes Ragging: - Ragging constitutes one or more of any of the following acts:

a. any conduct by any student or students whether by words spoken or written or by an act which has the effect of teasing, treating or handling with rudeness a fresher or any other student.
b. indulging in rowdy or undisciplined activities by any student or students which causes or is likely to cause annoyance, hardship, physical or psychological harm or to raise fear or apprehension thereof in any fresher or any other student.
c. asking any student to do any act which such student will not in the ordinary course do and which has the effect of causing or generating a sense of shame, or torment or embarrassment so as to adversely affect the physique or psyche of such fresher or any other student.
d. any act by a senior student that prevents, disrupts or disturbs the regular academic activity of any other student or a fresher.
e. exploiting the services of a fresher or any other student for completing the academic tasks assigned to an individual or a group of students.
f. any act of financial extortion or forceful expenditure burden put on a fresher or any other student by students.
g. any act of physical abuse including all variants of it: sexual abuse, homosexual assaults, stripping, forcing obscene and lewd acts, gestures, causing bodily harm or any other danger to health or person.
h. any act or abuse by spoken words, emails, posts, public insults which would also include deriving perverted pleasure, vicarious or sadistic thrill from actively or passively participating in the discomfiture to fresher or any other student.
i. any act that affects the mental health and self-confidence of a fresher or any other student with or without an intent to derive a sadistic pleasure or showing off power, authority or superiority by a student over any fresher or any other student.

1. Actions to be taken against students for indulging and abetting ragging in technical institutions Universities including Deemed to be University imparting technical education:

a) The punishment to be meted out to the persons indulged in ragging has to be exemplary and justifiably harsh to act as a deterrent against recurrence of such incidents.
b) Every single incident of ragging a First Information Report (FIR) must be filed without exception by the institutional authorities with the local police authorities.
c) The Anti-Ragging Committee of the institution shall take an appropriate decision, with regard to punishment or otherwise, depending on the facts of each incident of ragging and nature and gravity of the incident of ragging.
d) Depending upon the nature and gravity of the offence as established the possible punishments for those found guilty of ragging at the institution level shall be any one or any combination of the following:-
    (i) Cancellation of admission
    (ii) Suspension from attending classes
    (iii) Withholding/withdrawing scholarship/fellowship and other benefits
    (iv) Debarring from appearing in any test/examination or other evaluation process
    (v) Withholding results

(vi) Debarring from representing the institution in any regional, national or international meet, tournament, youth festival, etc.

(vii) Suspension/expulsion from the hostel

(viii) Rustication from the institution for period ranging from 1 to 4 semesters

(ix) Expulsion from the institution and consequent debarring from admission to any other institution.

(x) Collective punishment: when the persons committing or abetting the crime of ragging are not identified, the institution shall resort to collective punishment as a deterrent to ensure community pressure on the potential raggers.

Guidelines for Remedial Classes and Make-up Test (R20 Regulations)

The guidelines for conducting the remedial classes:

a) Faculty need to identify the underperforming students in their respective subject. An underperforming student is one, whose marks less than 50% in the I Mid Term Examination and AAT 1 together. A list of such students should be prepared by the faculty soon after the I Mid Term examination is over and get it signed by the concerned HOD.

d) Faculty should conduct remedial classes for the underperforming students with an objective of improving their marks in the CIE. Minimum number of remedial classes to be taken should be 20% of the classes taken prior the I Mid Term Examination which is 6 classes. Teaching methodology is left to the faculty member, but he/she should keep the objective in mind.

e) Regular students who could not appear for the I Mid Term Examination and AAT (with genuine reason) should appear to the remedial classes with the prior permission of the HOD.

f) The entire process of conduct of remedial classes should be well documented and is subjected to academic audit.

The guidelines for conducting the Make-up test:

a) A student can appear for a Make-up Test for **maximum two theory subjects** of a semester to improve marks in the Continuous Internal Evaluation (CIE).

b) A student is eligible for **Make-up test** which is conducted after the second Mid Term examination and before SEE examination if he/she satisfies the following conditions.

iv) Unable to secure 50% internal marks (CIE) and has more than or equal to 50% attendance in a particular theory subject (After finalizing the internal marks).

v) Attendance in Remedial classes is more than or equal to 65% (if Remedial classes are conducted) or greater than 50% marks in the I Mid Term Examination and AAT 1 together.

vi) Attended 50% of CIE tests (at least one AAT & one Mid Term Examinations).

The make-up test will be conducted for 30 marks (6 X 1M, 2X 12M) in Mid Examination format covering the entire syllabus and the marks obtained in this test are final. However, the maximum marks awarded will be 15 only.

g) The eligible students have to apply by paying a fee prescribed by the institution and submit the application along with a letter of request indicating the genuineness of his/her candidature to be eligible for the make-up test. Applications should be approved by the concerned HOD. After approval from the HOD the concerned department will conduct the make-up test and send the updated CIE marks to COE immediately.

APPLICATION FOR MAKE-UP TEST

Date:

1. Name of the Candidate :
2. Register Number :
3. Academic Year :
3. Branch :
4. Year & Semester of Study :
5. Student Mobile No. :

Make-up test Applied For:

S.No.	Sub Code	Subject Title	% of Subject Attendance in Regular Classes	CIE Marks				(To be filled by the concerned subject faculty)	
				AAT-1	Mid-1	AAT-2	Mid-2	% Attendance in Remedial Classes*	Signature
01									
02									

***** Write 'NA' if the student name is not in the remedial class list.

Signature of the Student Signature of the HOD

Fee Particulars:

The make-up test fee has to be paid through HDFC payment gateway and a printout of the receipt has to be taken. The student has to submit the office copy of the receipt in the COE office, get the signature and has to submit the signed application form along with student copy of the receipt in the department.

Amount paid in Rs	Date of payment	Signature of Exam Section Clerk

Note:

1. As per the "Make-up test guidelines", the eligible students have to fill this form, with the signature of the concerned subject faculty and the HOD.
2. After making the payment, the filled form along with a photocopy of the payment receipt has to be submitted in the department.
3. The make-up test will be scheduled and conducted by the department.

Guidelines for Internships

As per R20 guidelines, every student has to undergo internship twice, once between IV and V semester, the other between VI and VII Semester. The first internship is for a duration of 4 weeks and the second internship is for a duration of 6 weeks.

There shall be a departmental internship committee consisting of the Head of the Department and two faculty members nominated by the HOD. The committee shall identify the potential organizations which can provide internship opportunity to the students. The department shall enter into an MOU with the concerned organization and the details will be shared with the students.

The students shall be informed to apply for undergoing internship in the specified proforma. The details and consent of the organization in which he/she is seeking for internship are to be furnished. Further, the student along with the parent must submit an undertaking form. The committee shall scrutinize the applications and approve the same. If a student fails to acquire internship, he/she may be permitted to undergo equivalent work (mini project, research project, fabrication work, field work, research paper, etc.,) in the department under the guidance of a faculty member.

After the completion of the internship, the student must submit the report and attend a departmental internal assessment for award of grade and credits.

Internship Approval Proforma

Name of the Department
Name of the Student
Registered No
Email id
Mobile No
Academic Year
Internship Semester After VI Semester / After IV Semester

Internship Details

Internship Organization
Duration in weeks
Start Date of Internship
End Date of Internship
Probable Date of Certificate Submission

Note:
1. The consent letter from the organization is to be enclosed
2. Undertaking form from the student and parent

Signature of the Student

Recommendations of the Internship Committee:

Signature of the Head of the Department

Guidelines for Massive Open Online Courses (MOOCs)

1. Head of the department should constitute a three member MOOC committee under his chairmanship along with two more members.

2. The committee should take the responsibility of

(i) Notifying the MOOC courses twice in a semester (May and November) along with the details of portals offering the MOOC such as NPTEL/SWAYAM.
(ii) Checking the relevance of courses to the concerned branch.
(iii) Verifying the syllabus of chosen MOOC course and to ensure that it is not studied in the regular curriculum (either full or partial)

3. A student willing to take MOOCS course should apply in the prescribed format to the concerned Head of the Department at least one week prior to the commencement of the MOOC course.

4. The MOOC committee should ensure the following
(i) The course duration must be minimum of 12 weeks
(ii) The course should contain a proctored examination for evaluation
(iii) The agency offering MOOCs should be a recognized and reputed one and approved by
the BOS of the concerned program.

5. Students should submit the Course completion certificate with marks memos to the department MOOCs committee.

6. If the certifying authority/agency is not able to conduct the exam, then the student can show certified course progress, applied hall ticket and mail communication from the authority as proofs and can avail the extension time by one semester for submitting the course completion certificate.

7. After the student submits the MOOCs certificates, the committee should recommend 3 credits and the appropriate grade to be allocated to the student and send to the Controller of Examination.

8. If a student fails to successfully complete and acquire the certificate as per the guidelines and timelines specified by the concerned MOOCs authority, he/she has to register for that course subsequently. Unsuccessful candidates in the first attempt shall be marked as supplementary.

MOOCS APPLICATION

Date:

Name of the department:
Name of the Student:
Registered No:
Email id:
Mobile No:
Academic Year & Semester

S.No	Course Title	MOOCS Agency	Duration in Weeks	Course Start & End date	Probable Date of Certificate Submission	MOOCs Course in lieu of (Professional Elective/Job Oriented)	Remarks

Note: Syllabus, Timelines and Guidelines of the MOOC course should be attached.

Signature of the Student

Recommendations of the MOOCs Committee:

Signature of the Head of the Department

Guidelines for Project work

1. In R20 regulations, there is no theory or practical courses in VIII semester. An exclusive 12 credit course is included as Project Work and Internship. The student should mandatorily undergo internship as well as project work parallelly. At the end of the semester the student should submit an internship completion certificate along with a project report. A student shall also be permitted to submit project report on the work carried out during the internship.

2. The departmental internship committee is advised to strictly adhere to the established guidelines for internships. Furthermore, it is recommended that internships for students be limited to organization/ industry authorized by **APSCHE/AICTE INTERNSHIP PORTAL/PUBLIC SECTOR ORGANIZATIONS**. This restriction applies to both online and offline internship opportunities.

3. The Head of the department should constitute a three-member Project Work Committee (PWC) under his chairmanship with three faculty members as defined in the Process Document for project work (R20 regulation). The PWC shall adhere to the process explained in the said document.
4. Evaluation of the Project work:
   i) The evaluation shall be based on CIE and SEE. The CIE is for 30 marks which consists of reviews at the end of each month as per the Process Document in the form of seminars/presentations for 15 marks and the project report submitted at the end of the semester which is evaluated for 15 marks. A minimum of 15 (50%) marks and 50% attendance are to be secured by the student exclusively in CIE in order to be declared as qualified in the project work and eligible to write the SEE in the project work.
   ii) SEE shall be evaluated in the form of a Viva-Voce and demonstration of the thesis work for 70 marks. Viva-voce Examination in project work shall be conducted by one internal examiner (Member of PWC) and one external examiner to be appointed by the principal. A minimum of 25 marks shall be obtained exclusively in SEE in order to be declared as passed in the Project work.
   iii) Completion of internships along with Project work in VIII Semester is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student has to repeat and complete the internship.
5. The project work committee should ensure the following, if the students are doing project work at any organization/ industry.
   i) The student gets placement before commencement of eighth semester and joined the organization/Industry as advance placement. The student who obtained project work opportunity in organization / Industry may also be allowed as per the recommendation of the PWC.
   ii) The above students will be informed to apply in the specified proforma for approval to undergo for project work along with the details and consent of the organization in which he/she is seeking for doing project work. Further, the student and the parent/guardian have to submit an undertaking form to the concerned department. The PWC shall scrutinize the applications and approve.
   iii) The list of such approved students undertaking project work in organization/ industry shall be maintained in the department by the PWC.

iv) The students who are undertaking the project work out side the campus have to necessarily submit the monthly attendance duly certified by the concerned authority in the organization/ industry.

v) The PWC will have to maintain interaction regularly with the out-side organization/ concerned who are offering the project works.

vi) During the course of project work, the student has to attend the departmental internal reviews/assessment periodically as notified by the department mandatory. After the completion of the project work, the student has to submit the report and attend semester end assessment examination by paying prescribed exam fee for award of grade and credits.

vii) The students who are undertaking the project work outside the campus will have to complete their project work with in the stipulated period (as per Academic Calander) along with the inhouse project work students and also submit the internship completion certificate at the end of the semester.

Project work Approval Proforma

Date:

Name of the Department	
Name of the Student	
Registered No.	
Email id	
Mobile Number	
Academic Year and Semester	

Project Work Details:

Organization/Industry Name	
Duration in weeks	
Start Date of Project work	
End Date of Project work	
Probable Date of Project work completion Certificate Submission	

Note: 1. The Consent letter from the organization/Industry is to be enclosed.
2. Undertaking form from the student and parent.

Signature of the Student

Recommendations of the Project work Committee (PWC):

Signature of the Project Coordinator

Signature of the Head of the Department

Process document for Project work

As per the R20 regulations, students are required to do a project work in the VIII semester and submit a report. The following is the process to be followed for the project work.

A. Projects Batches and Guide allocation

1. The Head of the department should constitute a three-member Project Work Committee (PWC) under his chairmanship with three faculty members. One of them shall be a senior faculty member and acts as a Project Coordinator.
2. List of faculty members and their specializations, research areas will be communicated to the students. The information is disseminated via email, notice boards and display on the website. List of projects and their titles/themes should be identified and same may be communicated to all the students. Project batches are formed based on the performance of the students up to VI semester.
3. Students are given an option of specifying their choices for the project titles/guides and the final allocation of guides to project batches is done based on the merit order and the choices opted by the project batches.
4. It is to be ensured that no project batch should have more than 4 students.
5. Not more than two batches should be allocated to each project guide.

B. Project classification and mapping with program outcomes and program specific outcomes.

Projects may be broadly classified into the following categories.

1. Application oriented: When the project is related to hardware, then all the components are procured and assembled to get the desired outcome. If it is related to software, then a complete working version of the application is to be created.
2. Research oriented: In this category extensive review of literature is done. This aims to learn and implement new methods or procedures and validate results.
3. Simulation projects: These projects may be hardware or software related. The students will create a working prototype for the same.

- The PWC should ensure that the projects are selected in such a way that the program outcomes and program specific outcomes are mapped with the themes of the project works.
- A document consisting of project titles, area of specialization, project guides should be prepared and submitted to the concerned HOD and should be put on the website. The theme of the work may be changed with the consent of the project guide.

C. Continuous monitoring mechanism and evaluation

1. Project slots (24 hours per week) should be allocated as per the existing scheme and curriculum.
2. A laboratory or a class room should be identified for executing the project works. It is preferred to have a separate laboratory for the purpose of conducting the project works.
3. Each project batch is allowed to consult their respective guide to discuss about their Progress during the project slot.
4. At the end of every month there will be an overall assessment of each project by the PWC by scheduling project reviews in association with project guides.
5. The performance of the students should be evaluated in each review and should be documented.
6. Department staff meeting should be conducted to discuss the performance of the students in the projects and should be documented.

D. Methodology to assess individual as well as collective Contribution/understanding of Project:

1. The project guide should monitor the presence (attendance) of each student in the project work
2. The project guide should ensure that the batch allocated to him is able to understand the objectives of the project. The guide should also identify the requirements (hardware and software) of the project. If a particular software or hardware is not available, same may be communicated to the HOD and may be procured based on the financial and budgetary requirements.
3. Evaluation of the project is based on
    i. Understanding the objectives of the project.
    ii. Day to day work done by the students (Should be documented)
    iii. Partial/Full completion of the project
    iv. Students presentation and demonstration
    v. Results and documentation
4. Evaluation is intimated to the students for further improvement

F. Papers published/Awards won/conferences attended

1. It is encouraged for every project batch to publish/communicate a paper in any national/ international conference/journal. The project guide may encourage the students so that the work of their batch is published as a research paper.
2. Students must be given some awareness/training program for effective writing of a research paper. The research papers should be checked with anti-plagiarism software before the submission to the concerned journal or conference.
3. A report should be prepared by the concerned coordinator comprising all the research papers published and should be made available in the library and soft copies must be put on the website for availability to the students.

4 Year B.Tech Program
of
CSE (Data Science)

R-20(*Year 23*) Scheme & Syllabus
(w.e.f. 2023-2024)

DEPARTMENT OF CSE (DATA SCIENCE)

BAPATLA ENGINEERING COLLEGE :: BAPATLA

(AUTONOMOUS UNDER ACHARYA NAGARJUNA UNIVERSITY)

(SPONSORED BY BAPATLA EDUCATION SOCIETY)

BAPATLA - 522102 GUNTUR DISTRICT, A.P.

www.becbapatla.ac.in

SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
CSE (Data Science)

Summary

S. No.	Category	BEC Breakup of Credits
1	Humanities & Social Science including Management Courses	12.5
2	Basic Science courses	18
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.	22.5
4	Professional core courses	48
5	Professional Elective courses relevant to chosen specialization/branch	12
6	Open subjects – Electives from other technical and /or emerging subjects	16.5
7	Project work, seminar, and internship in industry or elsewhere	16.5
8	Mandatory Courses [Professional Ethics & Human Values, Indian Constitution, Essence of Indian Knowledge Tradition]	(non-credit)
9	Skill Oriented Subjects	14
Total		**160**

Semester Wise Courses and Credits

Semester	Credits	With Honor Credits
Semester-I	19.5	19.5
Semester-II	19.5	19.5
Semester-III	21.5	21.5
Semester-IV	21.5	25.5
Semester-V	21.5	25.5
Semester-VI	21.5	25.5
Semester-VII	23	27
Semester-VIII	12	16
Total	**160**	**180**

SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
CSE (Data Science)
First Year B.Tech. (SEMESTER – I) W.E.F. A.Y. 2023-24 (R-20(*Year 23*))

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total	
20DS101/ MA01	BS	Linear Algebra and Ordinary Differential Equations	2	1	0	3	30	70	100	3
20DS102/ PH03	BS	Semiconductor Physics and Nano Materials	3	0	0	3	30	70	100	3
20DS103/ EE01	ES	Basic Electrical & Electronics Engineering	3	0	0	3	30	70	100	3
20DS104/ EL01	HS	Communicative English	3	0	0	3	30	70	100	3
20DS105/ CS03	ES	Introduction to Problem Solving	2	0	2	4	30	70	100	3
20DSL101/ PHL02	BS	Semiconductor Physics Lab	0	0	3	3	30	70	100	1.5
20DSL102/ EEL01	ES	Basic Electrical & Electronics Engg. Lab	0	0	3	3	30	70	100	1.5
20DSL103/ ELL01	HS	English Communication Skills Lab	0	0	3	3	30	70	100	1.5
Induction Program		**First Three Weeks** (Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Familiarization to Dept./Branch & Innovations)								
TOTAL			**13**	**1**	**11**	**25**	**240**	**560**	**800**	**19.5**

L: Lecture T: Tutorial P: Practical
CIE: Continuous Internal Evaluation SEE: Semester End Examination

SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
CSE (Data Science)
First Year B.Tech. (SEMESTER – II) W.E.F. A.Y. 2023-24 (R-20(*Year 23*))

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total	
20DS201/ MA02	BS	Numerical Methods & Advanced Calculus	2	1	0	3	30	70	100	3
20DS202/ CY01	BS	Engineering Chemistry	3	0	0	3	30	70	100	3
20DS203/ CS01	ES	Programming for Problem Solving	2	1	0	3	30	70	100	3
20DS204/ CC01	ES	Digital Logic Design	3	0	0	3	30	70	100	3
20DS205/ CC02	ES	Discrete Mathematics	3	0	0	3	30	70	100	3
20DSL201/ CYL01	BS	Engineering Chemistry Lab	0	0	3	3	30	70	100	1.5
20DSL202/ CSL01	ES	Programming for Problem Solving Lab	0	0	3	3	30	70	100	1.5
20DSL203/ CSL03	ES	Computer Fundamentals Lab	0	0	3	3	30	70	100	1.5
20DS206/ MC01	MC	Environmental Studies	2	0	0	2	30	0	30	0
NSS	HS	National Service Scheme	-	-	-	-	-	-	-	0
TOTAL			**15**	**2**	**9**	**26**	**270**	**560**	**830**	**19.5**

SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
CSE (Data Science)
Second Year B.Tech. (SEMESTER – III) W.E.F. A.Y. 2023-24 (R-20(*Year 23*))

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total	
20DS301/ MA03	BS	Probability & Statistics	2	1	0	3	30	70	100	3
20DS302/ CC03	PC	Data Structures	2	1	0	3	30	70	100	3
20DS303/ CC04	PC	Object Oriented Programming	2	1	0	3	30	70	100	3
20DS304/ CC05	PC	Operating Systems	3	0	0	3	30	70	100	3
20DS305/ CC06	PC	Computer Organization	3	0	0	3	30	70	100	3
20DSL301/ SOC1	SO	Python Programming (Skill Oriented Course I)	2	0	3	5	30	70	100	3.5
20DSL302/ CC07	PC	Data Structures Lab	0	0	3	3	30	70	100	1.5
20DSL303/ CC08	PC	Object Oriented Programming Lab	0	0	3	3	30	70	100	1.5
20DS306/ MC02	MC	Professional Ethics & Human Values	2	0	0	2	30	0	30	0
TOTAL			**16**	**3**	**9**	**28**	**270**	**560**	**830**	**21.5**

SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
CSE (Data Science)
Second Year B.Tech. (SEMESTER – IV) W.E.F. A.Y. 2023-24 (R-20(*Year 23*))

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total	
20DS401/ MA06	ES	Mathematical Foundations for Data Sciences	2	1	0	3	30	70	100	3
20DS402/ CC09	PC	Web Technologies	3	0	0	3	30	70	100	3
20DS403/ CC10	PC	Database Management System	3	0	0	3	30	70	100	3
20DS404/ CC11	PC	Design & Analysis of Algorithms	2	1	0	3	30	70	100	3
20DS405/ EL02	HS	Technical English	3	0	0	3	30	70	100	3
20DSL401/ SOC2	SO	R Programming (Skill Oriented Course 2)	2	0	3	5	30	70	100	3.5
20DSL402/ CC12	PC	Web Technologies Lab	0	0	3	3	30	70	100	1.5
20DSL403/ CC13	PC	RDBMS Lab	0	0	3	3	30	70	100	1.5
TOTAL			**15**	**2**	**9**	**26**	**240**	**560**	**800**	**21.5**
20DSH4_ / 20DSM4_	Honors/Minor Course		3	1	0	4	30	70	100	4
Grand Total			**18**	**3**	**9**	**30**	**270**	**630**	**900**	**25.5**

SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
CSE (Data Science)
Third Year B.Tech. (SEMESTER – V) W.E.F. A.Y. 2023-24 (R-20(*Year 23*))

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total	
20DS501/ CC14	PC	Automata Theory & Formal Languages	2	1	0	3	30	70	100	3
20DS502/ CC15	PC	Computer Networks	3	0	0	3	30	70	100	3
20DS503/ CC16	PC	Software Engineering	3	0	0	3	30	70	100	3
20DS504/ PE1	PE	Professional Elective – I	3	0	0	3	30	70	100	3
20DS505/ JO1	JO	Job Oriented Elective – I	3	0	0	3	30	70	100	3
20DSL501/ SOC3	SO	Soft Skills (Skill Oriented Course 3)	1	0	2	3	30	70	100	2
20DSL502/ CC17	PC	Software Engineering Lab	0	0	3	3	30	70	100	1.5
20DSL503/ JO1	JO	Job Oriented Elective –I Lab	0	0	3	3	30	70	100	1.5
20DSL504/ INT01	INT	Summer Internship	0	0	0	0	0	100	100	1.5
20DS506/ MC03	MC	Essence of Indian Traditional Knowledge	2	0	0	2	30	0	30	0
TOTAL			**17**	**1**	**8**	**26**	**270**	**660**	**930**	**21.5**
20DSH5_ / 20DSM5_	**Honors/Minor Course**		**3**	**1**	**0**	**4**	**30**	**70**	**100**	**4**
Grand Total			**20**	**2**	**8**	**30**	**300**	**730**	**1030**	**25.5**

Professional Elective – I

1A	Artificial intelligence
1B	Data Warehousing & Data Mining
1C	Parallel Algorithms

Job Oriented Elective – I

1A	Enterprise Programming
	Enterprise Programming Lab
1B	Middleware Technologies
	Middleware Technologies lab
1C	Data Handling & Visualization
	Data Handling & Visualization Lab

*Summer Internship - I (INT01) need to be completed after 4th semester and it is evaluated by the end of 5th semester.

SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
CSE (Data Science)
Third Year B.Tech. (SEMESTER – VI) W.E.F. A.Y. 2023-24 (R-20(*Year 23*))

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total	
20DS601/ CC18	PC	Compiler Design	3	0	0	3	30	70	100	3
20DS602/ CC19	PC	Machine Learning	2	1	0	3	30	70	100	3
20DS603/ CC20	PC	Cryptography & Network Security	3	0	0	3	30	70	100	3
20DS604/ PE2	PE	Professional Elective –II	3	0	0	3	30	70	100	3
20DS605/ JO2	JO	Job Oriented Elective – II	3	0	0	3	30	70	100	3
20DSL601/ SOC4	SO	Full Stack Development (Skill Advanced Course 1)	2	0	3	5	30	70	100	3.5
20DSL602/ CC21	PC	Machine Learning Lab	0	0	3	3	30	70	100	1.5
20DSL603/ JO2	JO	Job Oriented Elective – II Lab	0	0	3	3	30	70	100	1.5
20DS606/ MC04	MC	India Constitution	2	0	0	2	30	0	30	0
TOTAL			**18**	**1**	**9**	**28**	**270**	**560**	**830**	**21.5**
20DSH6_ / 20DSM6_	**Honors/Minor Course**		**3**	**1**	**0**	**4**	**30**	**70**	**100**	**4**
Grand Total										

Professional Elective - II

2A	Distributed Systems
2B	Block Chain Technologies
2C	Reinforcement Learning

Job Oriented Elective – II

2A	Mobile Applications Development & Security
	Mobile Applications Development & Security Lab
2B	Industrial Internet of Things
	Industrial Internet of Things Lab
2C	Business Intelligence
	Business Intelligence Lab

SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
CSE (Data Science)
Fourth Year B.Tech. (SEMESTER – VII) W.E.F. A.Y. 2023-24 (R-20(*Year 23*)

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total	
20DS701/ PE3	PE	Professional Elective – III	3	0	0	3	30	70	100	3
20DS702/ PE4	PE	Professional Elective – IV	3	0	0	3	30	70	100	3
20DS703/ JO3	JO	Job Oriented Elective – III	3	0	0	3	30	70	100	3
20DS704/ OE_	OE	Open Elective	3	0	0	3	30	70	100	3
20DS705/ ME01	HS	Industrial Management & Entrepreneurship Development	3	0	0	3	30	70	100	3
20DSL701/ SOC5	SO	DevOps (Skill Advanced Course 2)	2	0	3	5	30	70	100	3.5
20DSL702/ JO3	JO	Job Oriented Elective – III Lab	0	0	3	3	30	70	100	1.5
20DSL703/ INT02	INT	Industrial/ Research Internship	0	0	0	0	0	100	100	3
TOTAL			**17**	**0**	**6**	**23**	**210**	**590**	**800**	**23**
20DSM7_ / 20DSH7_	**Honors/Minor Courses**		**3**	**1**	**0**	**4**	**30**	**70**	**100**	**4**
Grand Total			**20**	**1**	**6**	**27**	**240**	**660**	**900**	**27**

Professional Elective – III

3A	Wireless Networks
3B	Robotic Process Automation
3C	Social Network Analysis

Professional Elective – IV

4A	Artificial Neural Networks & Deep Learning
4B	Natural Language Processing
4C	Digital Forensics

Job Oriented Elective – III

3A	Cloud Programming
	Cloud Programming Lab
3B	Cyber Security
	Cyber Security Lab
3C	Big Data Analytics
	Big Data Analytics Lab

*Industrial/ Research Internship (INT02) need to be completed after 6th semester and it is evaluated by the end of 7th semester.

SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
CSE (Data Science)
Fourth Year B.Tech. (SEMESTER – VIII) W.E.F. A.Y. 2023-24 (R-20(*Year 23*))

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total	
20DS801/ PW01	PW	Project Work & Internship	0	0	24	24	30	70	100	12
Total			**0**	**0**	**24**	**24**	**30**	**70**	**100**	**12**
20DSHM1/ 20DSMM1	Honors/Minor Courses (MOOCs - 1)		0	0	0	0	0	0	0	2
20DSHM2/ 20DSMM2	Honors/Minor Courses (MOOCs - 2)		0	0	0	0	0	0	0	2
Grand Total			**0**	**0**	**0**	**0**	**30**	**70**	**100**	**16**

List of Open Electives

Department	Code	Name of the Subject
AIML	CM1	Artificial Intelligence
	CM2	Introduction to Machine Learning
CIVIL	CE1	Air Pollution and Control
	CE2	Remote Sensing and GIS
CB	CB1	Digital Forensics
	CB2	Introduction to Information Security and Cyber Laws
CSE	CS1	Database Management Systems
	CS2	Java Programming
DS	DS1	Data Warehousing and Data Mining
	DS2	Social Network Analysis
ECE	EC1	Digital Image Processing
	EC2	Embedded System & Design
EEE	EE1	Non-Conventional Energy Sources
	EE2	Electrical Energy Conservation and Auditing
	EE3	Industrial Electrical Systems
EIE	EI1	Sensors and Signal Conditioning
IT	IT1	Cyber Security
	IT2	Web Technologies
MECH	ME1	Automobile Engineering
	ME2	Renewable energy sources
	ME3	Project Management
	ME4	Entrepreneurship Development
CHEMISTRY	CY1	Chemistry in Space technology
	CY2	Artificial Intelligence in Sustainable Chemistry
	CY3	Material Chemistry in daily life
ENGLISH	EL1	Professional Communication
MATHS	MA1	Graph Theory
	MA2	Linear Algebra
PHYSICS	PH1	Nanomaterials and Technology
	PH2	Optoelectronic devices and applications
	PH3	Fiber optics communication
NCC	NCC	National Cadet Corps

List of Subjects offered under Honors in CSE(Data Science)

Note: - Students must acquire 20 credits for the award of Honors in CSE (Data Science).

- 16 credits (04 courses@ 4 credits each) should be earned through the following list of courses.
- 4 credits (02 courses@ 2 credits each) must be acquired through two MOOCs from the following list of courses with a minimum duration of 8/12weeks.

i.

ii. Before choosing those courses, students must complete prerequisites.

Code	List of HONOR Courses	Mode
A	Advanced Data Structures	Class Room
B	Advanced Computer Architecture	Class Room
C	Prompt Engineering & AI Tools	Class Room
D	Advanced Database Management Systems	Class Room
E	Real Time Operating Systems	Class Room
F	Advanced Computer Networks	Class Room
G	Applied Cryptography	Class Room
H	Software Project Management	Class Room
I	Numerical Optimization	Class Room
J	Web Semantics	Class Room
K	Spatial Informatics	MOOC
L	Reinforcement Learning	MOOC
M	Virtual Reality	MOOC
N	Cloud Computing	MOOC
O	Computational Complexity	MOOC
P	Competitive Programming	MOOC
Q	Affective Computing	MOOC
R	Computer Vision and Image Processing	MOOC
S	Social Networks	MOOC
T	Ethical Hacking	MOOC

Linear Algebra and Ordinary Differential Equations

I B. Tech. I Semester (20DS101/MA01)

Lectures:	2 Hours/week	Tutorial:	1 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: None

Course Objectives: Students will learn how to

- Solve a system of linear homogeneous and non-homogeneous equations, finding the inverse of a given square matrix and also its Eigen values and Eigen vectors
- Identify the type of a given differential equation and select and apply the appropriate analytical technique for finding the solution of first order ordinary differential equations.
- Create and analyze mathematical models using higher order differential equations to solve application problems that arise in engineering.
- Solve a linear differential equation with constant coefficients with the given initial conditions using Laplace Transforms.

Course Outcomes: After studying this course, the students will be able to

CO1 Find the eigen values and eigen vectors of a given matrix and its inverse.

CO2 Apply the appropriate analytical technique to find the solution of a first order ordinary differential equation.

CO3 Solve higher order linear differential equations with constant coefficients arise in engineering applications.

CO4 Apply Laplace transforms to solve differential equations arising in engineering

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-

UNIT-1 (12 Hours)

Linear Algebra: Rank of a Matrix; Elementary transformations of a matrix; Gauss-Jordan method of finding the inverse; Consistency of linear System of equations: Rouches theorem, System of linear Non-homogeneous equations, System of linear homogeneous equations; vectors; Eigen values; properties of Eigen values(without proofs); Cayley-Hamilton theorem (without proof).

[Sections: 2.7.1; 2.7.2; 2.7.6; 2.10.1; 2.10.2; 2.10.3; 2.12.1; 2.13.1; 2.14; 2.15.]

UNIT-2 (12 Hours)

Differential Equations of first order: Definitions; Formation of a Differential equation; Solution of a Differential equation; Equations of the first order and first degree; variables separable; Linear Equations; Bernoulli's equation; Exact Differential equations; Equations reducible to Exact equations: I.F found by inspection, I.F of a Homogeneous equation, In the equation M dx+ N dy = 0, $\frac{\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}}{N}$ is a function of x and $\frac{\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}}{M}$ is a function of y.

Applications of a first order Differential equations: Newton's law of cooling; Rate of decay of Radio-active materials.

[Sections: 11.1; 11.3; 11.4; 11.5; 11.6; 11.9; 11.10; 11.11; 11.12.1; 11.12.2; 11.12.4; 12.6; 12.8]

UNIT-3 (12 Hours)

Linear Differential Equations: Definitions; Theorem; Operator D; Rules for finding the complementary function; Inverse operator; Rules for finding the Particular Integral; Working procedure to solve the equation; Method of Variation of Parameters; Applications of Linear Differential Equations: Oscillatory Electrical Circuits.

[Sections: 13.1; 13.2.1; 13.3; 13.4; 13.5; 13.6; 13.7;13.8.1;14.1;14.5].

UNIT-4 (12 Hours)

Laplace Transforms: Definition; conditions for the existence; Transforms of elementary functions; properties of Laplace Transforms; Transforms of derivatives; Transforms of integrals; Multiplication by t^n; Division by t; Inverse transforms- Method of partial fractions; Other methods of finding inverse transforms; Convolution theorem(without proof); Application to differential equations: Solution of ODE with constant coefficients using Laplace transforms.

[Sections:21.2.1; 21.2.2; 21.3; 21.4; 21.7; 21.8; 21.9; 21.10; 21.12; 21.13; 21.14; 21.15.1]

Text Books :
1. B.S.Grewal, "Higher Engineering Mathematics", 44thedition, Khanna publishers, 2017.

References :
1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th edition, John Wiley & Sons.
2. N.P.Bali and M.Goyal, "A Text book of Engineering Mathematics" Laxmi Publications, 2010.

Semiconductor Physics and Nano Materials

I B. Tech. - I Semester (Code: 20DS102/PH03)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: None

Course Objectives: Students will be able to

- This unit aim to build the foundation and inspires interest of freshmen into electrical and electronics and to focus on fundamental concepts and basic principles regarding electrical conduction.
- This unit provides various properties of semiconductor materials and their importance in various device fabrications
- This unit aim to educate the student on various opto-electronic devices and their applications.
- This unit provide information about the principles of processing, manufacturing and characterization of nano materials, nanostructures and their applications

Course Outcomes: Students will be able to

CO1 Acknowledge the important aspects of earth magnetic field, concept of whole and effective mass of electron in semiconductors.
CO2 Maxwells equations in various magnetic applications
CO3 Use the fundamentals of optics, one can estimate physical parameters.
CO4 Realization of material properties and parameters.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	2	-	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	1	2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	2	-	-	-	-	-	-	-	-	-	-

UNIT-1 (12 Hours)

ELECTRONIC MATERIALS: Somerfield free electron theory, Fermi level and energy, density of states, Failure of free electron theory (Qualitative), Energy bands in solids, E-K diagrams, and Direct and Indirect band gaps. Types of Electronic materials: Metals, Semiconductors and Insulators, Occupation Probability, effective mass, Concept of hole

UNIT-2 (12 Hours)

SEMICONDUCTORS: Introduction to semiconductors, intrinsic and extrinsic semiconductors, carrier concentrations, Fermi level and temperature dependence, Continuity equation, Diffusion and drift, P-N junction (V-I characteristics), Metal – Semiconductor junction (Ohmic and Schottky), Semiconductor materials of interest for opto- electronic devices.

UNIT-3 (12 Hours)

OPTO-ELECTRONIC DEVICES AND DISPLAY DEVICES: Photo voltaic effect, principle and working of LED, Applications of Photo diode, Solar cell, PIN & APD Diode, Liquid crystal display, Opto electric effect: Faraday Effect and Kerr effect.

UNIT-4 (12 Hours)

NANO-MATERIALS: Introduction to nano technology, quantum confinement, surface to volume ratio, properties of nano materials, synthesis of nano-materials: CVD, sol-gel methods, laser ablation.

CARBON NANO TUBES: types, properties, applications. Characterization of nano materials: XRD, SEM, applications of nano materials.

Text Books:

1. A text book of engineering physics by Avadhanulu and KshirsagarS.Chand& Co. (2013)
2. Applied physics by Dr.*P.SrinivasaRao*. Dr.K.*Muralidhar*

References:

1. Introduction to solid state state physics, Charles Kittel, 8th edition
2. Solid state physics, S.O. Pillai
3. Text book on Nanoscience and Nanotechnology (2013): B.S. Murty, P. Shankar, Baldev Raj, B.B. Rath and J. Murday, Springer Science & Business Media.
4. Basic Engineering Physics ,Dr.*P.SrinivasaRao*. Dr.K.*Muralidhar*. Himalaya Publications, 2016

Basic Electrical and Electronics Engineering

I B. Tech. – I Semester (Code: 20DS103/EE01)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: None.

Course Objectives: Students will be able to

- To understand basic Laws in circuits, analysis of simple DC circuits, Theorems and its applications, fundamentals of AC circuits & its analysis and concepts of three phase balanced circuits
- To learn basic properties of magnetic materials and its applications.
- To understand working principle, construction, applications and performance of DC machines, AC machines.
- To learn basic concepts, working principal, characteristics and applications of semiconductor diode and transistor family.
- To gain knowledge about the static converters and regulators.
- To learn basic concepts of power transistors and operational amplifiers closer to practical applications.

Course Outcomes: Students will be able to

CO1 Solve problems involving with DC and AC excitation sources in electrical circuits.
CO2 Compare properties of magnetic materials and its applications
CO3 Analyze construction, principle of operation, application and performance of DC machines and AC machines.
CO4 Explore characteristics and applications of semiconductor diode and transistion family.
CO5 Make the static converters and regulators
CO6 Analyze concepts of power transistors and operational amplifiers closer to practical applications

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	1	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO6	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-

UNIT-1 12 Hours

Electrical Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase AC circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-2 12 Hours

Electrical Machines: Magnetic materials, BH characteristics, Construction, working of DC machines, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections. Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction and working of synchronous generators.

UNIT-3 12 Hours

Semiconductor Diodes and applications: Semiconductor materials, semiconductor diode, Resistance levels, Diode equivalent circuits, Zener diode, Light emitting diode, Load line analysis, half wave rectification, Full wave rectification, Bridge rectifier, Use of capacitor filter in rectifier, Zener diode voltage regulator, Clippers, Clampers

Bipolar Junction Transistors: Transistor construction and operation, Common base configuration, Transistor amplifying action, Common emitter configuration, Common collector configuration, Limits of operation. DC load line and bias point, Voltage divider bias of transistor.

UNIT-4 12 Hours

Field Effect Transistors: Construction and characteristics of JFET and MOSFET

Operational Amplifiers: Introduction, Differential and common mode operation, OP-AMP Basics, Practical OP-AMP circuits: Inverting amplifier, Non inverting amplifier, Unity follower, summing amplifier, Integrator and differentiator

Text Books :
1. S.K. Bhattacharya, "Basic Electrical and Electronics Engineering", Pearson Publications
2. Robert L. Boylestad& Louis Nashelsky, ' Electronic Devices and circuit theory', PHI Pvt.Limited, 11th edition
3. "Basics of Electrical and Electronics Engineering", Nagsarkar T K and Sukhija M S, Oxford press University Press.

References :
1. David A. Bell, 'Electronic Devices and Circuits', oxford publisher,5th edition
2. "Basic Electrical, Electronics and Computer Engineering", Muthusubramanian R, Salivahanan S and Muraleedharan K A, Tata McGraw Hill, Second Edition, (2006).

Communicative English

I B. Tech. – I Semester (Code: 20DS104/EL01)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: None.

Course Objectives: Students will be able to

- To comprehend the importance, barriers and strategies of listening skills in English.
- To illustrate and impart practice Phonemic symbols, stress and intonation.
- To practice oral skills and receive feedback on learners' performance.
- To practice language in various contexts through pair work, role plays, group work and dialogue conversations

Course Outcomes: Students will be able to

CO1 Understand how to build academic vocabulary to enrich their writing skills
CO2 Produce accurate grammatical sentences
CO3 Analyze the content of the text in writing
CO4 Produce coherent and unified paragraphs with adequate support and detail

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	-	-	-	-	-	-	-	2	2	3	2	2	-	2	-
CO2	-	-	-	-	-	-	-	2	2	3	2	2	-	2	-
CO3	-	-	-	-	-	-	-	2	2	3	2	2	-	2	-
CO4	-	-	-	-	-	-	-	2	2	3	2	2	-	2	-

UNIT-1 12 Hours

1.1 **Vocabulary Development:** Word formation-Formation of Nouns, Verbs & Adjectives from Root words-Suffixes and Prefixes
1.2 **Essential Grammar:** Prepositions, Conjunctions, Articles
1.3 **Basic Writing Skills:** Punctuation in writing
1.4 **Writing Practices:** Mind Mapping, Paragraph writing (structure-Descriptive, Narrative, Expository & Persuasive)

UNIT-2 12 Hours

2.1 **Vocabulary Development:** Synonyms and Antonyms
2.2 **Essential Grammar:** Concord, Modal Verbs, Common Errors
2.3 **Basic Writing Skills**: Using Phrases and clauses
2.4 **Writing Practices**: Hint Development, Essay Writing

UNIT-3 12 Hours

3.1 **Vocabulary Development:** One word Substitutes
3.2 **Essential Grammar:**Tenses, Voices
3.3 **Basic Writing Skills:** Sentence structures (Simple, Complex, Compound)
3.4 **Writing Practices:** Note Making

UNIT-4 12 Hours

4.1 **Vocabulary Development**: Words often confused
4.2 **Essential Grammar**: Reported speech, Common Errors
4.3 **Basic Writing Skills**: Coherence in Writing: Jumbled Sentences
Writing Practices: Paraphrasing &Summarizing

Text Books :

1. Communication Skills, Sanjay Kumar &PushpaLatha. Oxford University Press:2011.
2. Practical English Usage, Michael Swan. Oxford University Press:1995.
3. Remedial English Grammar, F.T.Wood. Macmillan:2007.
4. Study Writing, Liz Hamplyons & Ben Heasley. Cambridge University Press:2006

Introduction to Problem Solving

I B. Tech. – I Semester (Code: 20DS105/ CS03)

Lectures:	2 Hours/week	Tutorial:	0 Hours/week	Practical:	2 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: None.

Course Objectives:

- Understand basic concepts of C Programming such as: C-tokens, Operators, Input/output, and Arithmetic rules.
- Develop problem-solving skills to translate 'English' described problems into programs written using C language.
- Use conditional branching, looping and Arrays.
- Understand the concepts of functions and recursion in C.

Course Outcomes: At the end of this course, Students will be able to

CO1 Choose the right data representation formats based on the requirements of the problem and solve the mathematical problems using operators.
CO2 Solve problems which contain multiple decisions using else…if.
CO3 Work with lists and matrices using arrays.
CO4 Solve real time complex problems by decomposition using user defined functions.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	1	-	1	-	-	-	-	-	-	-	3	2
CO2	-	1	3	2	1	1	-	-	-	-	-	-	-	2	1
CO3	-	1	2	3	-	1	-	-	-	-	-	-	-	2	2
CO4	2	1	1	2	-	1	-	-	-	-	-	-	-	2	1

UNIT-I

Introduction to components of a computer system: Memory, processor, I/O Devices, storage.
Software: system software, application software, computer classifications, generation of computer.
Procedure: steps involved in problem solving, Algorithm, Steps involved in algorithm development. Flow Chart, Advantages of Flowcharts, Symbols used in Flow Charts, Simple problems using flow chart, pseudo code method.

UNIT-II

Fundamental algorithms: exchange the values of two variables, counting, summation of a set of numbers, factorial computation, sine function computation, generation of the Fibonacci sequence, reverse the digits of an integer, base conversion, charter to number conversion.

UNIT-III

Factoring methods: finding the square root of a number, the smallest divisor of an integer, the greatest common divisor of two integers, generate prime numbers, computing the prime factors of an integer, generation of pseudo-random numbers, raising a number to a large power.

UNIT-IV

Array Techniques: array order reversals, remove of duplicates from an order array, finding the Kth smallest element, finding the kth largest element and higher dimensional arrays.
Efficiency of algorithm: redundant computation, referencing array elements, inefficiency duo to late termination, early detection of desired output conditions, trading storage for efficiency gain.
Analysis of algorithms: computational complexity, order notation, best, worst and average case behavior.

Text Books :
1. How to Solve it by Computer, R.G. Dromey, First Edition, 2006, Pearson..

References :
1. Programming in ANSI C by E. Balaguruswamy, Fifth Edition.
2. Kernighan BW and Dennis Ritchie M, "C programming language", 2nd ed, Prentice Hall.

Semiconductor Physics Lab

I B.Tech – I Semester (Code: 20DSL101/PHL02)

Lectures:	0 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	1.5

Pre-Requisite: None.

Course Objectives: Students will be able to

- Basic experiments such as Magnetic Field Measurements, Hall Effect and LCR resonance give the knowledge to apply them in magnetic applications.
- The experiments CRO, Solar Cell, LASER diode provides the thorough understanding of OPTO Electronic devices useful in Engineering and Industrial applications.
- The measurements relating to various physical parameters of materials make the student to understand their utility, design and fabrication of several devices

Course Outcomes: Students will be able to

CO1	Acknowledge the important aspects of earth magnetic field, realize the use of Maxwells equations in various magnetic applications
CO2	Realization of material properties and parameters.
CO3	Get hands on experience in various opto-electronic devices like Solar Cell, Photo Cell and their applications.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	2	-	-	-	-	2	-	-	-	2	-	-
CO2	3	3	2	2	-	-	-	-	2	2	-	-	2	-	-
CO3	3	3	2	2	2	-	-	-	2	-	-	-	2	-	-

List of Experiments

1. Determination of acceleration due to gravity at a place using compound pendulum.
2. Study the variation of intensity of magnetic field along the axis of a circular coil using Stewart-Gee's apparatus.
3. Determination of thickness of thin wire using air wedge interference bands
4. Determination of radius of curvature of a Plano convex lens by forming Newton's rings..
5. Determination of wavelengths of mercury spectrum using grating normal incidence method.
6. Determination of dispersive power of a given material of prism using prism minimum deviation method.
7. Draw the resonant characteristic curves of L.C.R. series circuit and calculate the resonant frequency.
8. Draw the characteristic curves of a photocell and calculate the maximum velocity of electron.
9. Verify the laws of transverse vibration of stretched string using sonometer.

10. Determine the rigidity modulus of the given material of the wire using Torsional pendulum.
11. Draw the load characteristic curves of a solar cell.
12. Determination of Hall coefficient of a semiconductor.
13. Determination of voltage and frequency of an A.C. signal using C.R.O.
14. Determination of Forbidden energy gap of Si &Ge.
15. Determination of wavelength of laser source using Diode laser.

Any three experiments are virtual

Text Books :

1. Engineering physics laboratory manual P.Srinivasarao & K.Muraldhar, Himalaya publications.

Basic Electrical and Electronics Engineering Lab

I B.Tech – I Semester (Code: 20DSL102/EEL01)

Lectures:	0 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	1.5

Pre-Requisite: None.

Course Objectives: Students will be able to

- To understand basic Laws in circuits, analysis of simple DC circuits, Theorems and its applications, fundamentals of AC circuits & its analysis and concepts of three phase balanced circuits.
- To learn basic properties of magnetic materials and its applications.
- To understand working principle, construction, applications and performance of DC machines, AC machines.
- To learn basic concepts, working principal, characteristics and applications of semiconductor diode and transistor family.
- To gain knowledge about the static converters and regulators.
- To learn basic concepts of power transistors and operational amplifiers closer to practical applications.

Course Outcomes: Students will be able to

CO1 Validate the basic network theorems such as KCL, KVL, superposition, Thevenin's and Norton's theorems.

CO2 Measure the parameters of choke coil.

CO3 Figure out the parameters, regulation, and efficiency of single-phase transformer.

CO4 Discriminate between the characteristics of PN junction diode, Zener diode and Transistor.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	1	3	-	-	-	-	3	2	-	-	3	-	-
CO2	3	3	1	3	-	-	-	-	3	2	-	-	3	-	-
CO3	3	3	1	3	-	-	-	-	3	2	-	-	3	-	-
CO4	3	3	1	3	-	-	-	-	3	2	-	-	3	-	-

LIST OF EXPERIMENTS

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Verification of Thevenin's theorem
4. Verification of Norton's theorem
5. Parameters of choke coil
6. Measurement of low and medium resistance using volt ampere method
7. OC & SC test of single phase transformer
8. Load test on single phase transformer

9. V-I characteristics of PN junction Diode
10. V-I characteristics of Zener Diode
11. Characteristics of CE Configuration
12. Transfer and Drain Characteristics of JFET
13. Calculation of Ripple factor using Half wave rectifier
14. Calculation of Ripple factor using Full wave rectifier
15. Nonlinear wave shaping – clippers/clampers

Note: Minimum 10 experiments should be carried.

English Communication Skills Lab

I B. Tech. – I Semester (Code: 20DSL103/ELL01)

Lectures:	0 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	1.5

Pre-Requisite: None.

Course Objectives: Students will be able to

- To comprehend the importance, barriers and strategies of listening skills in English.
- To illustrate and impart practice Phonemic symbols, stress and intonation.
- To practice oral skills and receive feedback on learners' performance.
- To practice language in various contexts through pair work, role plays, group work and dialogue conversations

Course Outcomes: Students will be able to

CO1	Better understand the nuances of English language through audio- visual experience and group activities
CO2	Develop neutralization of accent for intelligibility
CO3	Build confidence to enhance their speaking skills
CO4	Use effective vocabulary both in formal and informal situations

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	-	-	-	-	-	-	-	-	3	2	2	2	-	2	-
CO2	-	-	-	-	-	-	-	-	3	2	2	2	-	2	-
CO3	-	-	-	-	-	-	-	-	3	2	2	2	-	2	-
CO4	-	-	-	-	-	-	-	-	3	2	2	2	-	2	-

List of Exercises

1.1 Listening Skills; Importance – Purpose- Process- Types

1.2 Barriers to Listening

1.3 Strategies for Effective Listening

2.1 Phonetics; Introduction to Consonant, Vowel and Diphthong sounds

2.2 Stress

2.3 Rhythm

2.4 Intonation

3.1Formal and Informal Situations

3.2 Expressions used in different situations

3.3 Introducing Yourself & Others-Greeting & Parting-Congratulating-Giving Suggestions & Advices-Expressing Opinions-Inviting People-Requesting-Seeking Permission-Giving Information- Giving Directions- Sympathizing- Convincing People- Complaining & Apologizing-Thanking Others- Shopping- Travelling- Conversational Gambits

4.1 JAM Session

4.2 Debates

4.3 Extempore

Text Books :

1. Communication Skills, Sanjay Kumar and Pushpa Lata. Oxford University Press. 2011
2. Better English Pronunciation, J.D. O' Connor. Cambridge University Press:1984
3. New Interchange (4rth Edition), Jack C Richards. Cambridge University Press:2015
4. English Conversation Practice, Grant Taylor. McGraw Hill:2001

Software:

1. Buzzers for conversations, New Interchange series
2. English in Mind series, Telephoning in English
3. Speech Solutions, A Course in Listening and Speaking

Numerical Methods and Advanced Calculus

I B. Tech. – II Semester (Code: 20DS201/MA02)

Lectures:	2 Hours/week	Tutorial:	1 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: None.

Course Objectives: Students will be able to

- Solve algebraic, transcendental and system of linear equations with the help of numerical methods.
- Apply the techniques of numerical integration whenever and wherever routine methods are not applicable and solve the first order ordinary differential equations numerically with the given initial condition using different methods.
- Evaluate double and triple integrals and apply them to find areas and volumes.
- Evaluate the line, surface and volume integrals and learn their inter-relations and applications.

Course Outcomes: Students will be able to

CO1	Solve non-linear equations and system of linear equations with the help of Numerical techniques.
CO2	Solve the first order ordinary differential equations numerically with the given initial condition.
CO3	Find the area and volume of plane and three dimensional figures using multiple integrals.
CO4	Apply vector integral theorems to obtain the solutions of engineering problems involving circulation, flux, and divergence in vector fields.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	-	-	-	-	-	-	-	-	2	-	3	-
CO2	3	3	2	-	-	-	-	-	-	-	-	2	-	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	2	-	2	-
CO4	3	3	2	-	-	-	-	-	-	-	-	2	-	3	-

UNIT-1 12 Hours

Numerical Solution of Equations: Introduction; Solution of algebraic and transcendental equations: Bisection method, Method of false position, Newton-Raphson method; Useful deductions from the Newton-Raphson formula; Solution of linear simultaneous equations; Direct methods of solution: Gauss elimination method, Gauss-Jordan method, Factorization method; Iterative methods of solution: Jacobi's iterative method, Gauss-Seidel iterative method.
[Sections: 28.1; 28.2; 28.3; 28.5; 28.6; 28.7.1; 28.7.2].

UNIT-2 12 Hours

Finite differences and Interpolation: Finite differences: Forward differences, Backward differences; Newton's interpolation formulae: Newton's forward interpolation formula, Newton's backward interpolation formula; Interpolation with unequal intervals; Lagrange's interpolation formula; Divided differences; Newton's divided difference formula; Numerical integration; Trapezoidal rule; Simpson's one-third rule; Simpson's three-eighth rule; Numerical solution of ODE's: Introduction; Picard's method; Euler's method; Runge-Kutta method.
[Sections:29.1; 29.1-1; 29.1.2; 29.6; 29.9; 29.10; 29.11; 29.12; 30.4; 30.6; 30.7; 30.8; 32.1; 32.2; 32.4; 32.7].

UNIT-3 12 Hours

Multiple Integrals: Double integrals; Change of order of integration; Double integrals in polar coordinates; Area enCOsed by plane curves; Triple integrals; Volumes of solids: Volume as Triple integrals, Change of variables.

[Sections: 7.1; 7.2; 7.3; 7.4; 7.5; 7.6.2; 7.7.2].

UNIT-4 12 Hours

Vector calculus and its Applications: Scalar and vector point functions; Del applied to scalar point functions-Gradient: Definition, Directional derivative; Del applied to vector point functions: Divergence, Curl; Line integral; Surfaces: Surface integral, Flux across a surface; Green's theorem in the plane (without proof); Stokes theorem (without proof); Gauss divergence theorem (without proof).

[Sections: 8.4; 8.5.1; 8.5.3; 8.6; 8.11; 8.12; 8.13; 8.14; 8.16]

Text Books :
1. B.S.Grewal, "Higher Engineering Mathematics", 44thedition, Khanna publishers, 2017.

References :
1. ErwinKreyszig, "Advanced Engineering Mathematics", 9th edition, John Wiley & Sons.
2. N.P.Bali and M.Goyal, "A Text book of Engineering Mathematics" Laxmi Publications, 2010.

Engineering Chemistry

I B. Tech. – II Semester (Code: 20DS202/CY01)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: None.

Course Objectives: Students will be able to

- With the principles of water characterization and treatment of water for industrial purposes and methods of producing water for potable purposes.
- To understand the thermodynamic concepts, energy changes, concept of corrosion & its control.
- With the conventional energy sources, solid, liquid and gaseous Fuels & knowledge of knocking and anti-knocking characteristics
- With aim to gain good knowledge of organic reactions, plastics, conducting polymers & biodegradable polymers.

Course Outcomes: Students will be able to

CO1 Develop innovative methods to produce soft water for industrial use and potable water at cheaper cost

CO2 Apply their knowledge in converting various energies of different systems and protection of different metals from corrosion

CO3 Have the capacity of applying energy sources efficiently and economically for various needs.

CO4 With aim to gain good knowledge of organic reactions, plastics, conducting polymers & biodegradable polymers

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	3	2	3	-	2	3	-	-	-	-	3	-	-	-
CO2	2	3	2	3	-	2	3	-	-	-	-	3	-	-	-
CO3	2	3	2	3	-	2	3	-	-	-	-	3	-	-	-
CO4	2	3	3	3	-	2	3	-	-	-	-	3	-	-	-

UNIT-1 12 Hours

Introduction: water quality parameters

Characteristics: Alkalinity, Hardness - Estimation & simple numerical problems,

Boiler Troubles - Sludges, Scales, Caustic embrittlement, boiler corrosion, Priming and foaming;

Internal conditioning- phosphate, calgon and carbonate methods.

External conditioning - Ion exchange process & Zeolite process WHO Guidelines, Potable water, Sedimentation, Coagulation, Filtration.

Disinfection methods: Chlorination, ozonization and UV treatment.

Salinity – Treatment of Brackish water by Reverse Osmosis and Electrodialysis.

UNIT-2 12 Hours

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications.

Corrosion: Types of corrosion - Chemical or dry corrosion, Electrochemical or wet corrosion; Galvanic, stress, pitting and differential aeration corrosion; Factors effecting corrosion, **Corrosion control** – Cathodic protection, and electro plating (Au) & electrodes Ni plating.

UNIT-3 12 Hours

Fuels: Classification of fuels; Calorific value of fuels (lower, higher)
Solid fuels: Determination of calorific value (Bomb Calorimeter) & related problems, Coal ranking.
Liquid Fuels: Petroleum refining and fractions, composition and uses. Knocking and anti- knocking Agents, Octane number and Cetane number; Bio fuels- Biodiesel, general methods of preparation and advantages
Gaseous fuels: CNG and LPG,
Flue gas analysis – Orsat apparatus.

UNIT-4 12 Hours

Organic reactions and synthesis of a drug molecule
Introduction to reactions involving substitution (SN^1, SN^2), addition (Markownikoff's and anti-Markwnikoff's rules) , elimination (E_1& E_2), Synthesis of a commonly used drug molecule.(Aspirin and Paracetamol)
Polymers: Conducting polymers: Classification, Intrinsic and Extrinsic conducting polymers and their applications**.** Plastics: Thermoplasts and thermosetting plastics, Bskelite and PVC.
Bio degradable polymers: types, examples-Polyhydroxybuterate (PHB), Polyhydroxybuterate-co-β-hydroxyvalerate (PHBV), applications.

Text Books :
1. P.C. Jain and Monica Jain, "Engineering Chemistry" DhanpatRai Pub, Co., New Delhi 17th edition (2017).
2. SeshiChawla, "Engineering Chemistry" DhanpatRai Pub, Co LTD, New Delhi 13 th edition, 2013.

References :
1. Essential of Physical Chemistry by ArunBahl, B.S. Bahl, G.D.Tuli, by ArunBahl, B.S. Bahl, G.D.Tuli, Published by S Chand Publishers, 12th Edition, 2012.
2. Engineering Chemistry by C.P. Murthy, C.V. Agarwal, A. Naidu B.S. Publications, Hyderabad (2006).
3. Engineering Chemistry by K. Maheswaramma, Pearson publishers 2015.

Programming for Problem Solving

I B.Tech – II Semester (Code: 20DS203/CS01)

Lectures:	2 Hours/week	Tutorial:	1 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Introduction to Programming(24DS105/CS03)

Course Objectives: Students will be able to

- Understand basic concepts of C Programming such as: C-tokens, Operators, Input/output, and Arithmetic rules.
- Develop problem-solving skills to translate "English" described problems into Programs written using C language.
- Use Conditional Branching, Looping, and Functions.
- Apply pointers for parameter passing, referencing and differencing and linking data structures.
- Manipulate variables and types to change the problem state, including numeric, character, array and pointer types, as well as the use of structures and unions, File.

Course Outcomes: Students will be able to

CO1	Formulate simple algorithms for arithmetic and logical problems and remember the basics of computer fundamentals of computer history.
CO2	Translate the algorithms to programs also to test and execute the programs and correct syntax and logical errors and implementing conditional branching, iteration and recursion.
CO3	Analyze the problem for its decomposition into functions.
CO4	Understand the file handling and dynamic memory allocation using c programming language.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-
CO4	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-

UNIT-1 12 Hours

Overview of C, Constants, Variables and Data Types, Operators and Expressions, Managing I/O Operations. Decision Making and Branching.

Programming Exercises for Unit I: C-expressions for algebraic expressions, evaluation of arithmetic and Boolean expressions. Syntactic and logical errors in a given program, output of a given program, values of variables at the end of execution of a program fragment, Programs using Scientific and Engineering formulae. Finding the largest of the three given numbers. Computation of discount amount on different types of products with different discount percentages. Finding the class of an input character, finding the type of triangle formed with the given sides, computation of income-tax, finding given year is leap year or not, and conversion of lower case character to its uppercase.

UNIT-2 12 Hours

Decision Making and Looping, Arrays, Character Arrays and Strings.

Programming Exercises for UnitII: To print the sum of the digits of a given number and to display the image of a given number. To find whether a given number is prime, printing Fibonacci sequence and to find prime factors of a given number. To print graphic patterns of symbols and numbers. To find the length of a string, compare strings, reverse a string, copy a string and to find whether the given string is palindrome or not with and without using String Handling Functions. Transpose of a matrix and sorting of names using arrays.

UNIT-3 12 Hours

User-defined Functions, Structures and Unions, Pointers

Programming Exercises for Unit -III: Functions-Recursive functions to find factorial & GCD (Greatest Common Divisor), string operations using pointers and pointer arithmetic. Swapping two variable values. Sorting a list of student records on register number using array of pointers.

UNIT-4 12 Hours

File Management in C, Dynamic Memory Allocation, Preprocessor

Programming Exercises for Unit - IV: Operations on complex numbers, and to read an input file of marks and generate a result file, sorting a list of names using command line arguments. Copy the contents of one file to another file. Allocating memory to variables dynamically.

TextBooks :

1. "Programming in ANSIC" by E. Balaguruswamy, Fifth Edition, McGraw Hill Education India.
2. "Let us C" by Yashavant P.Kanetkar, 14th Edition, BPB Publications.

References:

1. Kernighan BW and Dennis Ritchie M, "C programming language", 2nd edition, Prentice Hall.
2. HerbertSchildt,"C:TheCompleteReference",4thedition,TataMcgraw-Hill.
3. AshokN.Kamthane,"ProgramminginC",PEARSON2ndEdition.
4. ReemaThareja, "Programming in C", Oxford University Press, 2nd Edition, 2015

Digital Logic Design

I B.Tech – II Semester (Code: 20DS204/CC01)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Basic Computer Knowledge.

Course Objectives: Students will be able to

- Understand of the fundamental concepts and techniques used in digital electronics, and Number conversions.
- Understand basic arithmetic operations in different number systems and simplification of Boolean functions using Boolean algebra and K-Maps.
- Simplify the Boolean functions using Tabulation method, Concepts of combinational logic circuits.
- Understand the concepts of Flip-Flops, Analysis of sequential circuits
- Understand the concepts of Registers, Counters and classification of Memory units.

Course Outcomes: Students will be able to

CO1 Understand different number systems and binary codes and conversion between number system. Understand and apply boolean algebra and K-maps to simplify Boolean functions

CO2 Understand and apply tabulation method to simplify the Boolean functions. Understand, analyze and design various combinational circuits.

CO3 Know the fundamentals of various flip flops and analyze and design sequential circuits.

CO4 Understand various registers, design various counters. Design various PLD's for Boolean functions.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-

UNIT-1 12 Hours

DIGITAL SYSTEMS AND BINARY NUMBERS: Digital System, Binary Numbers, Number base Conversions, Octal and Hexadecimal Numbers, Complements of Numbers, Signed Binary Numbers, Binary Codes, Binary Storage and Registers, Binary Logic, Error Detection and Correction: 7 bit Hamming Code.

BOOLEAN ALGEBRA & LOGIC GATES: Introduction, Basic definitions, Axiomatic definition of Boolean algebra, Basic theorems and properties of Boolean algebra, Boolean functions, Canonical and Standard Forms, Other Logic Operations, Digital logic gates.

GATE –LEVEL MINIMIZATION: Introduction, The map method, Four-variable K-Map, Product-of-Sums Simplification, Don't –Care Conditions, NAND and NOR implementation, Other Two level Implementations.

UNIT-2 12 Hours

MINIMIZATION: The Tabulation method, Determination of prime implicants, Selection of prime-implicates.

COMBINATIONAL LOGIC: Introduction, Combinational Circuits, Analysis Procedure, Design Procedure, Binary Adders - Subtractor, Decimal Adder, Magnitude Comparator, Decoders, Encoders, Multiplexers.

UNIT-3 12 Hours

SYNCHRONOUS SEQUENTIAL LOGIC: Introduction, Sequential Circuits, Storage Elements - Latches, Storage Elements -Flip Flops, Analysis of Clocked Sequential Circuits: State Equations, State Table, State Diagram, Flip Flop Input Equations, Analysis with D, JK and T Flip Flops; State reduction and Assignment, Design Procedure.

UNIT-4 12 Hours

REGISTERS and COUNTERS: Registers, Shift registers, Ripple Counters, Synchronous Counters.

MEMORY and PROGRAMMABLE LOGIC: Introduction, Random Access Memory: Read and Write Operations, Types of Memories; Read Only Memory, Programmable Logic Devices: PROM, PLA, PAL.

Text Books :
1. M. Morris Mano, Michael D. Ciletti, "Digital Design", 5th Edition,PrenticeHall, 2013.
2. A. Anand Kumar, "fundamentals of digital circuits", 4th Edition, PHI.

References :
1. John F. Wakerly, "Digital Design: Principles and Practices", 4th Edition, Pearson, 2006.
2. Brian Holdsworth , Clive Woods, "Digital Logic Design", 4th Edition, Elsevier Publisher, 2002.
3. Donald E Givone, "digital principles and design", TMT.

Discrete Mathematics

I B.Tech – II Semester(Code: 20DS205/CC02)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: None.

Course Objectives: Students will be able to

- Understand and apply operations on sets, functions, and relations; construct and verify mathematical arguments using logic, truth tables, connectives, quantifiers, and methods of proof.
- Verify arguments with rules of inference, apply algorithms in number theory, and use counting techniques in discrete probability.
- Understand sequences, generating functions, and recurrence relations; compute coefficients and solve homogeneous relations.
- Solve inhomogeneous recurrence relations; study properties of binary relations, partial orderings, lattices; construct graphs and adjacency matrices.

Course Outcomes: Students will be able to

CO1	Understand the basic principles of sets, relations, functions and inference rules for validating arguments.
CO2	Prove that the given statement is valid by using mathematical induction and utilize a variety of counting strategies to solve computational problems.
CO3	Discuss different methods for solving different types of recurrence relations.
CO4	Understand various operations and representations of a binary relation.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-

UNIT-1 12 Hours

Foundations: Sets, Relations and Functions, Fundamentals of Logic, Logical Inferences, Methods of Proof of an implication, First order Logic & Other methods of proof.

UNIT-2 12 Hours

Rules of Inference for Quantified propositions, Mathematical Induction.

Elementary Combinatorics: Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with repetitions, Enumerating Permutation with Constrained repetitions..

UNIT-3 12 Hours

Recurrence relations: Generating functions of sequences, Calculating Coefficients of Generating Functions.

Recurrence Relations: Solving recurrence relations by Substitution and generating functions, The methods of characteristic roots.

UNIT-4 12 Hours

Recurrence Relations: solutions of Inhomogeneous recurrence relations.

Relations: Special properties of binary relations, Operations on relation. Ordering relations, Lattice, Paths and Closures, Directed Graphs and Adjacency Matrices.

Text Books : 1. Toe L.Mott, Abraham Kandel &TheodoreP.Baker, "Discrete Mathematics Computer Scientists & Mathematicians", PHI 2nd edition, 2012.

References : 1. C.L. Liu, "Elements of Discrete Mathematics", McGraw-Hill Education, 2nd edition.

2. Rosen, "Discrete Mathematics". ", McGraw-Hill Education, 8th edition.

Chemistry Lab

I B.Tech – II Semester (Code: 20DSL201/CYL01)

Lectures:	0 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	1.5

Pre-Requisite: None.

Course Objectives: Students will be able to

- The basics of chemistry lab to carry out the qualitative and quantitative analysis of any given sample.
- To determine the percentage purity of washing soda bleaching powder and given salt. The measurement of quality parameters of water to check its suitability for domestic and industrial purpose
- To estimate the characteristic properties of oil for its use at various level
- To synthesize the Soap, Resin and Aromatic Ester followed by their applications. The use and utility of some instruments like PH meter, Conduct meter and Potentiometer for various applications

Course Outcomes: Students will be able to

CO1	Familiar with fundamental basics of Chemistry lab.
CO2	Ability to estimate purity of washing soda, bleaching powder and quantity of Iron and other salts.
CO3	Gain the knowledge regarding the quality parameters of water like salinity, hardness, alkalinity etc.
CO4	Able to analyse the given oil for saponification and iodine value.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	2	2	-	2	-	-	-	-	-	2	-	-	-
CO3	2	2	2	2	-	2	-	-	-	-	-	2	-	-	-
CO4	2	2	2	2	-	-	-	-	-	-	-	2	-	-	-

LIST OF EXPERIMENTS

1. Introduction to Chemistry Lab (the teachers are expected to teach fundamentals like Calibration of Volumetric Apparatus, Primary, Secondary Solutions, Normality, Molarity, Molality etc. and error, accuracy, precision, theory of indicators, use of volumetric titrations).

2. **Volumetric Analysis:**
   a. Estimation of Washing Soda.
   b. Estimation of Active Chlorine Content in Bleaching Powder
   c. Estimation of Mohr's salt by permanganometry.
   b. Estimation of given salt by using Ion-exchange resin using Dowex-50.

3. **Analysis of Water**:
   a. Determination of Alkalinity of Tap water.
   b. Determination of Total Hardness of ground water sample by EDTA method

c. Determination of Salinity of water sample.

4. **Estimation of properties of oil:**
   a. Estimation of Acid Value
   b. Estimation of Saponification value.

5. **Preparations:**
   a. Preparation of Soap
   b. Preparation of Urea-formaldehyde resin
   c. Preparation of Phenyl benzoate.

Text Books :

1. Practical Engineering Chemistry by K.Mukkanti, Etal, B.S. Publicaitons, Hyderabad, 2009.
2. Inorganic quantitative analysis, Vogel, 5th edition, Longman group Ltd. London, 1979.

References :

1. Text Book of engineering chemistry by R.n. Goyal and HarrmendraGoel.
2. A text book on experiments and calculations- Engineering Chemistry. S.S. Dara.
3. Instrumental methods of chemical analysis, Chatwal, Anand, Himalaya Publications.

Programming for Problem Solving Lab

I B.Tech – II Semester (Code: 20DSL202/CSL01)

Lectures:	0 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	1.5

Pre-Requisite: None.

Course Objectives: Students will be able to

- Understand basic concepts of C Programming such as: C-tokens, Operators, Input/output, and Arithmetic rules.
- Develop problem-solving skills to translate "English" described problems into Programs written using C language
- Use Conditional Branching, Looping, and Functions.
- Apply pointers for parameter passing, referencing and differencing and linking data structures.
- Manipulate variables and types to change the problem state, including numeric, character, array and pointer types, as well as the use of structures and unions, File

Course Outcomes: Students will be able to

CO1	Address the challenge, pick and analyze the appropriate data representation formats and algorithms.
CO2	Choose the best programming construct for the job at hand by comparing it to other structures and considering their constraints.
CO3	Develop the program on a computer, edit, compile, debug, correct, recompile and run it.
CO4	Identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO2	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO3	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO4	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3

LIST OF EXPERIMENTS

1. A program for electricity bill taking different categories of users, different slabs in each category. (Using nested if else statement).

Domestic Customer:		
Consumption Units	**Rate of Charges(Rs.)**	
0 – 200	0.50 per unit	
201 – 400	100 plus	0.65 per unit
401 – 600	230 plus	0.80 per unit
601 and above	390 plus	1.00 per unit
Commercial Customer:		
Consumption Units	**Rate of Charges(Rs.)**	
0 – 50	0.50 per unit	
100 – 200	50 plus	0.60 per unit
201 – 300	100 plus	0.70 per unit
301 and above	200 plus	1.0 per unit

2. Write a C program to evaluate the following (using loops):
    a) $1 + x^2/2! + x^4 / 4!+ \ldots$upto ten terms
    b) $x + x^3/3! + x^5/5!+ \ldots$ upto 7 digit accuracy
3. Write a C program to check whether the given number is
    a) Prime or not.
    b) Perfect or Abundant or Deficient.
4. Write a C program to display statistical parameters (using one – dimensional array).
    a) Mean
    b) Mode
    c) Median
    d) Variance.
5. Write a C program to read a list of numbers and perform the following operations
    a) Print the list.
    b) Delete duplicates from the list.
    c) Reverse the list.
6. Write a C program to read a list of numbers and search for a given number using Binary search algorithm and if found display its index otherwise display the message "Element not found in the List".
7. Write a C program to read two matrices and compute their sum and product.
8. A menu driven program with options (using array of character pointers).
    a) To insert a student name
    b) To delete astudent name
    c) To print the names of students
9. Write a C program to read list of student names and perform the following operations
    a) To print the list of names.
    b) To sort them in ascending order.
    c) To print the list after sorting.
10. Write a C program that consists of recursive functions to
    a) Find factorial of a given number
    b) Solve towers of Hanoi with three towers (A, B & C) and three disks initially on tower A.
11. A Bookshop maintains the inventory of books that are being sold at the shop. The list includes details such as author, title, price, publisher and stock position. Whenever a customer wants a book the sales person inputs the title and the author, and the system searches the list and displays whether it is available or not. If it is not, an appropriate message is displayed, if it is, then the system displays the book details and request for the number of copies required, if the requested copies are available the total cost of the requested copies is displayed otherwise the message "required copies not in stock" is displayed. Write a program for the above in structures with suitable functions.
12. Write a C program to read a data file of students' records with fields (Regno, Name, M1,M2,M3,M4,M5) and write the successful students data (percentage > 40%) to a data file.

Computer Fundamentals Lab

I B.Tech – II Semester (Code: 20DSL203/CSL03)

Lectures:	0 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	1.5

Pre-Requisite: None.

Course Objectives:

- Introduce the internal parts of a computer, peripherals, and I/O ports.
- Demonstrate configuring the system with Windows Operating System and other Application Software's.
- Introduce Office tools such as Word processors, Excel and Presentation tools.
- Demonstrate Drawing flowcharts such as Raptor Tool.

Course Outcomes: At the end of this course, Students will be able to

CO1 Explore computer system peripherals and components of a mother board and evaluate computer system architectures.
CO2 Troubleshoot a computer system.
CO3 Prepare a PPT, Certificate and Calculate GPA and Generate a report using Mail merge.
CO4 Implement flowcharts using Raptor Tool.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	1	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-	3	1	-
CO4	-	-	3	1	3	-	-	-	-	-	-	-	3	2	-

List of Experiments

Experiment 1: Computer Hardware Basics: PC Hardware introduces the students to a personal computer and its basic peripherals, the process of assembling a personal computer, installation of system software like MS Windows, Linux and the required device drivers. In addition, hardware and software level troubleshooting process, tips and tricks would be covered.
Every student should identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor. Every student should disassemble and assemble the PC back to working condition.

Experiment 2: Installation of Software: Every student should individually install operating system like Linux or MS windows on the personal computer. The system should be configured as dual boot with both windows and Linux.

Experiment 3: Hardware Troubleshooting: Students have to be given a PC which does not boot due to improper assembly or defective peripherals. They should identify the problem and fix it to get the computer back to working condition.

Experiment 4: Software Troubleshooting: Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition.

Experiment 5: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate how to access the websites and email.

Experiment 6: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured. Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. Usage of search engines like Google, Yahoo, ask.com and others should be demonstrated by student.

Experiment 7: Cyber Hygiene: Students should learn about viruses on the internet and install antivirus software. Student should learn to customize the browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

Experiment 8: Drawing flowcharts (Raptor Tool): Students should draw flowcharts for the problems validating an email id entered by user, printing first fifty numbers and preparing electricity bill.

Experiment 9: Productivity tool: Microsoft (MS) office: Importance of MS office, Details of the three tasks and features that should be covered in each, MS word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter. Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Experiment 10: Practice with MS Word to create project certificate: Features to be covered: - Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colours, Inserting Header and Footer, Using Date and Time option in Word.

Experiment 11: Orientation on Spread sheet: Accessing, overview of toolbars, saving spreadsheet files, Using help and resources. Creating a Scheduler: - Gridlines, Format Cells, Summation, auto fill, Formatting Text

Experiment 12: Creating Power Point: Student should work on basic power point utilities and tools in Ms Office which help them create basic power point presentation. PPT Orientation, Slide Layouts, Inserting Text, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows, Hyperlinks, Inserting Images, Tables and Charts.

Text Books :
1. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
2. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dreamtech.
3. Computer Fundamentals, l e, Anita Goel, Person Education.

References :
1. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme. – CISCO Press, Pearson Education.

Environmental Studies

I B. Tech. – II Semester (Code: 20DS206/MC01)

Lectures:	2 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	00	Credits:	0

Pre-Requisite: None.

Course Objectives: Students will be able to

- To develop an awareness, knowledge, and appreciation for the natural environment.
- To understand different types of ecosystems exist in nature.
- To know our biodiversity.
- To understand different types of pollutants present in Environment.
- Create awareness among the youth on environmental concerns important in the long-term interest of the society

Course Outcomes: Students will be able to

CO1	Develop an appreciation for the local and natural history of the area.
CO2	Hope for the better future of environment in India which is based on many positive factors like Biodiversity, successive use of renewable energy resources and other resources, increasing number of people's movements focusing on environment.
CO3	Know how to manage the harmful pollutants. Gain the knowledge of Environment.
CO4	Create awareness among the youth on environmental concerns important in the long-term interest of the society

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	-	-	-	-	-	3	3	-	-	-	-	2	-	-	-
CO2	-	-	-	-	-	3	3	-	-	-	-	2	-	-	-
CO3	-	-	-	-	-	3	3	-	-	-	-	2	-	-	-
CO4	-	-	-	-	-	3	3	-	-	-	-	2	-	-	-

UNIT-1 8 Hours

Introduction: Definition, Scope and Importance, Need for public awareness. Ecosystems: Definition, Structure and Functions of Ecosystems, types - Forest, Grassland, Desert, Aquatic (Marine, pond and estuaries).

Biodiversity: Definition and levels of Biodiversity; Values of Biodiversity - Consumptive, Productive, Social, Aesthetic, Ethical and Optional; Threats and Conservation of Biodiversity; Hot Spots of Biodiversity, Bio-geographical Classification of India, India as a mega diversity nation. Chipko movement case study

UNIT-2 8 Hours

Natural resources: Land: Land as a resource, Causes and effects of land degradation - Soil erosion, Desertification. **Forest**: Use of forests, Causes and effects of deforestation, Afforestation, Mining - benefits and problems. **Water**: Uses, floods and drought, Dams - benefits and problems.

Energy: Importance of energy, Environmental Impacts of Renewable and Non-renewable energy resources. Silent Valley Project and Narmada BachaoAndolan case studies

Sustainability: Definition, Concept and Equitable use of resources for sustainable development; Rain water harvesting and Watershed management. Fieldwork on Rain water harvesting and Watershed management.

UNIT-3 8 Hours

Pollution: Definition; Causes, effects and control of air, water and nuclear pollution; Chernobyl Nuclear Disaster case study; Solid Waste: urban, Industrial and hazardous wastes; Integrated waste management - 3R approach, composting and vermicomposting.

Environmental acts: Water and air (Prevention and Control of pollution) acts, Environmental protection act, Forest Conservation act.

UNIT-4 8 Hours

Environmental issues: Green House effect & Global warming, Ozone layer depletion, Acid rains, Green Revolution, Population Growth and environmental quality, Environmental Impact Assessment. Environmental Standards (ISO 14000, etc.)

Case Studies: Bhopal Tragedy, Mathura Refinery and TajMahal, and Ralegan Siddhi (Anna Hazare).

Field work: Visit to a local area to document environmental assets – Pond/Forest/Grassland. Visit to a local polluted site- Urban and industry/ Rural and Agriculture.

Text Books :

1. "Environmental Studies" by Benny Joseph, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. "Comprehensive environmental studies"- JP Sharma, Laxmi Publications.
3. Text Book of environmental Studies – ErachBharucha

References :

1. "Environmental studies", R.Rajagopalan, Oxford University Press.
2. "Introduction to Environmental Science", Anjaneyulu Y, B S Publications
3. "Environmental Science", 11th Edition – Thomson Series – By Jr. G. Tyler Miller.

Probability and Statistics

II B. Tech. III Semester 20DS301/MA03

Lectures:	2 Hours/week	Tutorial:	1 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: None.

Course Objectives: Students will be able to

- Apply the continuous probability densities to various problems in science and engineering.
- Estimate the point and interval estimators of the mean, variance and proportion for the given Sample data and apply Z-test, t-test to various real-life problems
- Apply various sample tests like F-test and $\chi 2$ -test for decision making regarding the population based on sample data.
- Compute the level of correlation, the best fit curve to the given data by the method of least squares and also perform ANOVA arising in the field of engineering.

Course Outcomes: Students will be able to

CO1	Apply discrete and continuous probability distributions to various problems arising in Engineering applications.
CO2	Perform Test of Hypothesis for a population parameter for single sample.
CO3	Perform Test of Hypothesis for population parameters for multiple samples.
CO4	Interpret the results of correlation, regression and one way ANOVA for the given data.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	-	-	-	-	-	-	-	-	-	2	-	3	-
CO2	3	3	2	-	-	-	-	-	-	-	-	2	-	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	2	-	3	-
CO4	3	3	3	-	-	-	-	-	-	-	-	2	-	3	-

UNIT-1 12 Hours

Continuous Random Variables, Normal Distribution, Normal Approximation to the Binomial Distribution, Uniform Distribution, Gamma Distribution and its applications, Beta Distribution and its applications, Weibull distribution, Joint Distributions (Discrete), Joint Distributions (Continuous). (Sections 5.1, 5.2, 5.3, 5.5,5.7, 5.8, 5.9, 5.10)

UNIT-2 12 Hours

Populations and Samples, The sampling distribution of the mean (σ known), The sampling distribution of the mean (σ unknown), The sampling distribution of the variance, Point estimation, Interval estimation, Tests of Hypotheses, Null Hypothesis and Tests of hypotheses, Hypothesis concerning one mean. (Sections 6.1, 6.2, 6.3, 6.4, 7.1, 7.2, 7.4, 7.5, 7.6)

UNIT-3 12 Hours

Comparisons-Two independent Large samples, Comparisons-Two independent small samples, matched pairs comparisons, The estimation of variances, Hypotheses concerning one variance, Hypotheses concerning two variances. (Sections 8.2, 8.3, 8.4, 9.1, 9.2, 9.3)

UNIT-4 12 Hours

Estimation of proportions, Hypotheses concerning one proportion, Hypotheses concerning several proportions. The method of least squares, curvilinear regression, multiple regression, correlation, Completely Randomized Designs. (10.1, 10.2, 10.3, 11.1, 11.3, 11.4, 11.6, 12.1, 12.2)

Text Books :

1. Miller & Freund's "Probability and Statistics for Engineers", Richard A. Johnson, 8th Edition, PHI.

References :

1. ErwinKreyszig, "Advanced Engineering Mathematics", 9th edition, John Wiley & Sons.
2. N.P.Bali and M.Goyal, "A Text book of Engineering Mathematics" Laxmi Publications, 2010.
3. R.E Walpole, R.H. Myers & S.L. Myers 'Probability & Statistics for Engineers and Scientists', 6th Edition, PHI.
4. Murray R Spiegel, John J.Schiller, R. AluSrinivasa, 'Probability &Satistics', Schaum's outline series.

Data Structures

II B.Tech – III Semester(Code: 20DS302/CC03)

Lectures:	2 Hours/week	Tutorial:	1 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Problem Solving using Programming (20DS204)

Course Objectives: Students will be able to

- Understand the role of Data structures in structuring and analysis procedure of an algorithm.
- Learn the concept of Stack, Queue and various Sorting techniques.
- Understand the concept of Binary Tree, Binary Search Tree and AVL tree.
- Learn the concept of Hashing and Heap Data Structures.

Course Outcomes: Students will be able to

CO1	Analyze the algorithms to determine the time & space complexity and manipulating data using array or list representation.
CO2	Implement the applications of Stack & Queue and analyze the various sorting techniques.
CO3	Construct and implement different tree algorithms like binary tree, BST and AVL tree.
CO4	Implement and analyze various hashing techniques and priority queues.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	3	-

UNIT-1 (12 Hours)

Algorithm Analysis: Mathematical Background, Model, what to Analyze, Running Time Calculations.

Lists: Abstract Data Types, The List ADT, Singly Linked List ADT, Doubly Linked List ADT, Circular Linked List ADT, Polynomial ADT: addition, multiplication operations.

UNIT-2 (12 Hours)

Stacks and Queues: The Stack ADT and its applications such as Infix to Postfix expression conversions, Evaluation of Postfix expressions. The Queue ADT, Queue Application-Radix sort.

Basic Sorting Techniques: Bubble sort, Selection sort, Insertion sort, Shell sort

UNIT-3 (12 Hours)

Trees: Preliminaries, Binary Trees, Expression trees, The Search Tree ADT, Binary Search Trees, Implementations, AVL Trees-Single Rotations, Double rotations, Implementations.

UNIT-4 (12 Hours)

Hashing: General Idea, Hash Function, Separate Chaining, Open Addressing.

Priority Queues (Heaps): Model, Simple implementations, Binary Heap, Heap Sort.

Text Books: 1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education , 2013, Second Edition, ISBN- 978-81-7758-358-8.

References:
1. Y.Langsam, M.J.Augeustein and A.M.Tenenbaum, "Data Structures Using C", Pearson Education Asia, 2006, Second Edition, ISBN- 81-203-1177-9.
2. Richard F.Gilberg, Behrouz A. Forouzan, "Data Structures – A Pseudocode Approach with C", Thomson Brooks / COLE, 1998, Second Edition, ISBN-978-0-534-39080-8
3. Aho, J.E. Hopcroft and J.D. Ullman, "Data Structures andAlgorithms", Pearson Education Asia, 1983, 1st edition, ISBN- 978-0201000238.

Object Oriented Programming

II B. Tech. – III Semester (Code: 20DS303/CC04)

Lectures:	2 Hours/week	Tutorial:	1 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: None.

Course Objectives: Students will be able to

- Understand advantages of OO programming over procedural oriented programming; learn the basics of variables, operators, control statements, arrays, classes and objects.
- Understand, write and implement the following concepts: Inheritance, Interfaces, Packages, Strings and Collections.
- Understand and write programs on Exception Handling, I/O, and Multithreading.
- Understand and implement applications using Applets, AWT, Swings and Events.

Course Outcomes: Students will be able to

CO1 Demonstrate OOP concepts, its advantages over structured programming.
CO2 Develop and implement Inheritance, polymorphism.
CO3 Analyze Exception Handling, Multithreading, I/O.
CO4 Create code for Event Handling, Applets, AWT and Swings.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	-	-	-	-	-	-	-	-	3	3	3	3
CO2	3	3	3	-	-	-	-	-	-	-	-	3	3	3	3
CO3	3	3	3	-	-	-	-	-	-	-	-	3	3	3	3
CO4	3	3	3	-	-	-	-	-	-	-	-	3	3	3	3

UNIT-1 (12 Hours)

The History and Evolution of Java
An Overview of Java
Data Types, Variables and Arrays
Operators
Control Statements
Introducing Classes
A Closer Look at Methods and Classes

UNIT-2 (12 Hours)

Inheritance
Packages and Interfaces
Strings: String Constructors, Any 10 String class methods, StringBuffer class, Any 10 StringBuffer class methods, Introducing StringBuilder class.
Type Wrappers: Auto boxing/unboxing.
Collections: Collections Overview, Names of Collection Interfaces,
Collection Classes: LinkedList<String>, Array List<String>

UNIT-3 (12 Hours)

Exception Handling
Multithreaded Programming
I/O: I/O Basics, Reading Console Input, Writing Console Output, The Print Writer class, Reading and Writing Files, Automatically Closing a File.

UNIT-4 (12 Hours)

The Applet Class: Applet Architecture, An Applet Skeleton, Applet program to draw shapes, setting Color, Font using Graphics class

Event Handling:

Introducing the AWT: Window Fundamentals, **AWT components:** Label, Text Field, Text Area, Checkbox, Checkbox Group, Button, **Layout Managers:** Flow Layout, Grid Layout, and Border Layout.

GUI Programming with Swing: The Origins of Swing, Advantages of Swing over AWT, The MVC Connection, **Swing Components:** JLabel, JText Field, JText Area, JCheck box, JButton, JTabbed Pane, JTable, JTree, JCombo Box

Text Books:

1. "Java The Complete Reference", 9th Edition, Herbert Schildt, TMH Publishing Company Ltd, New Delhi, 2014.

References:

1. "Big Java ", 4th Edition, Cay Horstman, John Wiley & Sons, 2009.
2. "Java How to Program (Early Objects)", H. M. Dietel and P. J. Dietel, 11th edition Pearson Education, 2018.

Operating Systems

II B.Tech – III Semester(Code: 20DS304/CC05)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: None

Course Objectives: Students will be able to

- To learn the mechanism of OS to handle processes & Threads and their communication.
- To learn the algorithms involved in CPU scheduling.
- To gain knowledge on concepts that includes Dead locks, Main Memory and Virtual Memory.
- To know the concepts related to File Access Methods & Mass Storage structure.

Course Outcomes: Students will be able to

CO1 Understand different structures, services of the operating system, the use of scheduling and operations on process & threads.

CO2 Develop various process scheduling algorithms for a given specification of CPU utilization, throughput, TAT, WT & RT.

CO3 Develop various Memory Organization Techniques for optimally allocate memory to process by increasing Memory Utilization & Access time.

CO4 Design & implement various file allocation methods & Disk Scheduling Algorithms.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	3	-	-	-	-		-	-		-	3	-	-

UNIT-1 (12 Hours)

Introduction: What OSs Do, Computer System Operation, Storage structure, OS Structure, OS Operations.

Operating-System Structures: OS Services, User and operating system Interface, System Calls, Types of System Calls, System Programs, OS Design and Implementation, OS Structure.

Processes: Process Concept, Process Scheduling, Operations on Processes, Inter- process Communication.

Threads: Overview, Multicore Programming, Multithreading Models.

[Sections:1.1, 1.2.1, 1.2.2,1.4,1.5, 1.5.1,2.1, 2.2,2.3,2.4, 2.5, 2.6, 2.7,2.7.1,2.7.2,2.7.3,2.7.4 3.1, 3.2,3.3,3.4, 4.1,4.2,4.3]

UNIT-2 (12 Hours)

CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms.

Process Synchronization: Background, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic problems of Synchronization, Monitors.

[Sections : 6.1,6.2,6.3, 5.1,5.2,,5.3,5.4,5.5,5.6,5.7,5.8]

UNIT-3 (12 Hours)

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Avoidance, Detection and Recovery.

Main Memory: Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of Page Table.
Virtual-Memory: Background, Demand Paging, Copy-on-Write, Page Replacement, Allocation of Frames, Thrashing, Other Considerations.
[Sections; 7.1,7.2,7.3,7.4,7.5,7.6,7.7,8.1,8.2,8.3,8.4,8.5,8.6,9.1, 9.2,9.3,9.4,9.5,9.6,9.9]

UNIT-4 (12 Hours)

File System Interface: File concept, Access Methods, Directory and Disk Structure,
File System Implementation: File System Structures, Directory Implementation, Allocation Methods
Protection: Goals of Protection, Principles of Protection, Domain of Protection- Domain Structure, Access Matrix, Implementation of Access Matrix.
Mass Storage Structure: Over View, Disk Structure, Disk Scheduling, Disk Management, RAID levels
[Sections:10.1,10.2,10.4,10.5,10.7,11.1,11.2,11.3,11.5,12.1,12.3,12.4,14.1,14.2,14.3,14.3.1,14.4, 14.5]

Text Books:
1. Silberschatz & Galvin, "Operating System Concepts", 10th edition, John Wiley & Sons (Asia) Pvt.Ltd. **ISBN 9781118063330.**

References:
1. William Stallings, "Operating Systems –Internals and Design Principles", 9/e, Pearson. ISBN 9789352866717
2. Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Co., 2019 edition. **ISBN-9780074635513**
3. Andrew S.Tanenbaum, "Modern Operating Systems", 4nd edition,2017 PHI.**ISBN-9781292061429**

Computer Organization

II B. Tech. – III Semester (Code: 20DS305/CC06)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Digital Logic Design(20DS205)

Course Objectives: Students will be able to

- Represent the data, micro-operations, and hardware implementation of arithmetic, logic and shift unit.
- Know about the instruction codes and generation of control signals using hardwired and micro-programmed approaches.
- Learn about the different types of instructions and arithmetic operations.
- Understand the organization of the memory and I/O units.

Course Outcomes: Students will be able to

CO1 Representation of the data, micro-operations, and implementation of hardware for arithmetic, logic and shift unit.

CO2 Understand the flow of execution of instruction by the CPU and design of the control unit using hardwired and micro-programmed approaches.

CO3 Study the instruction set of basic computer and draw the flowcharts of the arithmetic operations.

CO4 Understand the memory and I/O organizations.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	-	-	-	-	2	-	2	-	3	3	3	3
CO2	3	3	3	-	-	-	-	2	-	2	-	3	3	3	3
CO3	3	3	3	-	-	-	-	2	-	2	-	3	3	3	3
CO4	3	3	3	-	-	-	-	2	-	2	-	3	3	3	3

UNIT-1 (12 Hours)

DATA REPRESENTATION: Data Types, Complements, Fixed-Point Representation, Floating-Point Representation.

REGISTER TRANSFER LANGUAGE AND MICROOPERATIONS: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro Operations, Logic micro operations, Shift Micro Operations, Arithmetic Logic Shift Unit.

UNIT-2 (12 Hours)

BASIC COMPUTER ORGANIZATION AND DESIGN: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input-Output and Interrupt, Design of Accumulator Logic.

MICRO PROGRAMMED CONTROL: Control Memory, Address Sequencing, Microprogram Example, Design of Control Unit.

UNIT-3 (12 Hours)

CENTRAL PROCESSING UNIT: General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer vs Complex Instruction Set Computers.

COMPUTER ARITHMETIC: Addition and Subtraction, Multiplication Algorithms, Division Algorithms.

UNIT-4 (12 Hours)

THE MEMORY SYSTEM: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

INPUT-OUTPUT ORGANIZATION: Peripheral Devices, Input-Output Interface, Modes of Transfer, Priority Interrupt, Direct Memory Access, Input-Output Processor.

Text Books:

1. Computer System Architecture, M. Morris Mano, 3rdEdition, Pearson/PHI

References:

1. Computer Organization, Carl Hamacher, ZvonksVranesic, Safea Zaky, 5th Edition, McGraw Hill.
2. Computer Organization and Architecture, William Stallings, Sixth Edition, Pearson/PHI.

Python Programming

(Skill Oriented Course – I)

II B.Tech – III Semester (Code: 20DSL301/SOC1)

Lectures:	2 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3.5

Pre-Requisite: None.

Course Objectives: Students will be able to

- Understand and write code using the basics of Python, Statements, Expressions, Conditional Executions, and Functions.
- Write code for Iteration, Strings, File I/O.
- Write code in creating, usage of Lists, Dictionaries, and Tuples.
- Understand the concepts of Object Orientation, Databases and write code implementing them.

Course Outcomes: Students will be able to

CO1	Identify the basic python constructs with a view of using them in problem solving.
CO2	Explore the usability of functions and strings in modular programming
CO3	Apply lists, dictionaries, tuples and file operations to organize the data in real world problems.
CO4	Implement the problems in terms of real world objects using object oriented and database concepts.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO2	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO3	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO4	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3

Syllabus

Introduction: Overview, History of Python, Python Features, Environment Setup. Variables, expressions, and statements: values and types, variables, names and keywords, statements, operators and operands, expressions, order of operations, modulus operator, string operations, asking the user for input, comments, choosing mnemonic variable names.

Conditional execution: Boolean expressions, logical operators, conditional execution,
Alternative execution, chained conditionals, nested conditionals, catching exceptions using try and except, short-circuit evaluation of logical expressions.

Functions: function calls, built-in functions, type conversion functions, random numbers, math functions, adding new functions, definitions and uses, flow of execution, parameters and arguments, fruitful functions and void functions.

Iteration: updating variables, the while statement, infinite loops and break, finishing iterations with continue, definite loops using for, loop patterns.

Strings: string is a sequence, getting the length of a string using len, traversal through a string with a loop, string slices, strings are immutable, looping and counting, the in operator, string comparison, string methods, parsing strings, format operator.

Files I/O:persistence, opening files, text files and lines, reading files, searching through a file, letting the user choose the file name, using try except and open, writing files.

Lists: a list is a sequence, lists are mutable, traversing, operations, slices, methods, deleting elements, functions, strings, parsing lines, objects and values, aliasing, arguments.
Dictionaries: dictionary as a set of counters, dictionaries and files, looping and dictionaries, advanced text parsing.
Tuples: tuples are immutable, comparing tuples, tuple assignment, dictionaries and tuples, multiple assignment with dictionaries, the most common words, using tuples as keys in dictionaries, sequences.
Object-Oriented Programming: Managing Larger Programs, Using Objects, starting with Programs, Subdividing a Problem–Encapsulation, First Python Object, Classes as Types, Object Lifecycle, Many Instances, Inheritance.
Using Databases and SQL: Database concepts, Database Browser for SQLite, creating a database table, Structured Query Language summary, Basic data modeling, Programming with multiple tables, three kinds of keys, Using JOIN to retrieve data.

List of Experiments

1. Write a python program to check if the number is positive or negative or zero and display an appropriate message.
2. Write a python program to take a string from user and count number of vowels present and percentage of vowels in it.
3. Write a python program to find the most frequent words in a text file.
4. Write a Python Program to Find the Sum of first n Natural Numbers.
5. Write a python program to find the numbers which are divisible by 7 and multiple of 5 between 1500 and 2700.
6. Write a Python Program to solve Quadratic Equation.
7. Create a program that ask the user for a number and then prints out a list of all the divisors of that number.
8. Write a Python Program to Find HCF or GCD.
9. Write a Python Program to Find LCM.
10. Write a Python program to construct the following pattern, using a nested loop number.

    1
    22
    333
    4444
    55555
    666666

11. Write a Python Program to sort the given words in Alphabetic Order.
12. Write a Python function to create the HTML string with tags around the word(s).
13. Write a Python program to reverse words in a string.
14. Write a Python program to strip a set of characters from a string.
15. Write a python function to find the maximum and minimum of a list of numbers.
16. Write a Python Program to Find the Square Root.
17. Write a Python Program to Convert Decimal to Binary Using Recursion.
18. Write a python recursive function to a find the factorial of a given number.
19. Write a python program to find the longest word in each line of given file.
20. Write a Python program to combine each line from first file with the corresponding line in second file.
21. Write a Python program to read a random line from a file.
23. Write a Python program to split a list every Nth element.

    Sample list: ['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i', 'j', 'k', 'l', 'm', 'n']
    Expected Output: [['a', 'd', 'g', 'j', 'm'], ['b', 'e', 'h', 'k', 'n'], ['c', 'f', 'i', 'l']]

24. Write a Python program to compute the similarity between two lists.
    Sample data: ["red", "orange", "green", "blue", "white"], ["black", "yellow", "green", "blue"]
    Expected Output:
    Color1-Color2: ['white', 'orange', 'red'] Color2-Color1: ['black', 'yellow']
25. Write a Python program to replace the last element in a list with another list.
    Sample data: [1, 3, 5, 7, 9, 10], [2, 4, 6,8] Expected Output: [1, 3, 5, 7, 9, 2, 4, 6, 8]
26. Write a Python program to find the repeated items of a tuple.
27. Write a Python program to convert a list with duplicates to a tuple without duplicates.
28. Write a Python program to reverse the elements of a tuple.
29. Write a Python program to replace last value of tuples in a list.
    Sample list: [(10, 20, 40), (40, 50, 60), (70, 80, 90)]
    Expected Output: [(10, 20, 100), (40, 50, 100), (70, 80, 100)]
31. Write a Python program to combine two dictionaries by adding values for common keys.
    d1 = {'a': 100, 'b': 200, 'c':300}
    d2 = {'a': 300, 'b': 200, 'd':400}
    Sample output: Counter({'a': 400, 'b': 400, 'd': 400, 'c': 300})
33. Write a Python program to create and display all combinations of letters, selecting each letter from a different key in a dictionary.
    Sample data : {'1':['a','b'], '2':['c','d']} Expected Output:
    ac ad bc bd
34. Write a Python program to get the top three items in a shop.
    Sample data: {'item1': 45.50, 'item2':35, 'item3': 41.30, 'item4':55, 'item5': 24} Expected Output:
    item4 55 item1 45.5
    item3 41.3
35. Write a Python program to match both key values in two dictionaries.
    Sample dictionary: {'key1': 1, 'key2': 3, 'key3': 2}, {'key1': 1, 'key2': 2}
    Expected output: key1: 1 is present in both x and y
36. Write a Python class named Rectangle constructed by a length and width and a method which will compute the area of a rectangle.
37. Write a Python class named Circle constructed by a radius and two methods which will compute the area and the perimeter of a circle.
38. Write a Python program to create a Single Linked List using classes.
39. Write a Python program to create a FIFO queue using classes.
40. Predict the output of following Python programs and write the justification. class X(object):

```
    def __init__(self,a):
       self.num = a
    def doubleup(self):
       self.num *= 2

class Y(X):
   def __init__(self,a): X.__init__(self, a)
   def tripleup(self):
      self.num *= 3

obj = Y(4)
print(obj.num)

obj.doubleup()
print(obj.num)
```

```
obj.tripleup()
print(obj.num)
```

41. Predict the output of following Python programs and write the justification.

```
# Base or Super class class Person(object):
   def __init__(self, name):
      self.name = name

   def getName(self):
      return self.name

   def isEmployee(self):
      return False

# Inherited or Subclass (Note Person in bracket)
class Employee(Person):
  def __init__(self, name, eid):
  ''' In Python 3.0+, "super().__init__(name)" also works'''
      super(Employee, self).__init__(name)
      self.empID = eid

   def isEmployee(self):
      return True

   def getID(self):
      return self.empID

# Driver code
emp = Employee("Geek1", "E101")
print(emp.getName(), emp.isEmployee(), emp.getID())
```

42. Create a employees database with the following attributes and insert rows. employee_id, first_name, last_name, email, phone_number, hire_date, job_id, salary, commission_pct, manager_id, department_id
43. Write a query to get the highest, lowest, sum, and average salary of all employees.
44. Write a query to get the average salary for all departments employing more than 10 employees.
45. Write a query to find the names (first_name, last_name), the salary of the employees whose salary is greater than the average salary.
46. Write a query to get nth max salaries of employees.

Text Books :
1. A Python Book: Beginning Python, Advanced Python, and Python Exercises, Dave Kuhlman, Open Source MIT License.
2. Python for Data Analysis, Wes McKinney, O' Reilly.

References :
1. Python Data Science Handbook-Essential Tools for Working with
2. Data Science from Scratch, JoelGrus, O'Reilly.

Data Structures Lab

II B. Tech. – III Semester (Code: 20DSL302/CC07)

Lectures:	0 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	1.5

Pre-Requisite: None.

Course Objectives: Students will be able to

- Understand and program basic data structures like arrays and linked lists with their applications.
- Understand and Program data structures like stacks and queues with their applications. Understand and implement sorting algorithms.
- Understand and program on trees, binary trees, binary search trees, avl trees, expression trees and their traversal methods.
- Understand and program on priority queues, hashing and their mechanisms. Basic knowledge of graphs representations and traversing methods.

Course Outcomes: Students will be able to

CO1	Understand the concept of Dynamic memory management, data types, algorithms, Big O notation.
CO2	Understand basic data structures such as arrays, linked lists, stacks and queues.
CO3	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data.
CO4	Solve problem involving trees and heaps, Describe the hash function and concepts of collision and its resolution methods

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO2	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO3	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO4	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3

LIST OF EXPERIMENTS

1. Write a program to perform the following operations on Array List
   a). Creation, b). Insertion, c). Deletion, d). Search, e). Display.
2. Write a program that reads two lists of elements, prints them, reverses them, prints the reverse list, sort the lists, print the sorted lists, merges the list, prints merge list using array list.
3. Write a program to perform the following operations on Single Linked List.
   a). Creation, b). Insertion, c). Deletion, d). Search, e). Display.
4. Write a program to perform the following operations on Doubly Linked List.
   a). Creation, b). Insertion, c). Deletion, d). Search, e). Display.
5. Write a program to perform addition and multiplication of two polynomials using single Linked List.
6. Write a program to convert the given infix expression into postfix expression using stack.
7. Write a program to evaluate the postfix expression using stack.
8. Write a program that performs Radix sort on a given set of elements using queue.
9. Write a program to read n numbers in an array. Redisplay the array list with elements being

sorted in ascending order using the following techniques
a). Bubble Sort, b). Selection Sort, c). Insertion Sort, d).Shell Sort.

10. Write a program to perform Binary Search tree operations and traversals.
11. Write a program to implement AVL tree that interactively allows
    a). Insertion, b). Deletion, c). Find_min, d). Find_max.
12. Write a program to read n numbers in an array. Redisplay the arraylist with elements being sorted in ascending order using Heap Sort.

Text Books:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education

References:

1. Y.Langsam, M.J.Augeustein and A.M.Tenenbaum, "DataStructures Using C", Pearson Education Asia, 2004.
2. Richard F.Gilberg, Behrouz A. Forouzan, "Data Structures – A Pseudocode Approach with C", ThomsonBrooks / COLE, 1998.

Object Oriented Programming Lab

II B.Tech – III Semester (Code: 20DSL303/CC08)

Lectures:	0 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	1.5

Pre-Requisite: None.

Course Objectives: Students will be able to

- Understand advantages of OO programming over procedural oriented programming, learn the basics of variables, operators, control statements, arrays, classes and objects.
- Understand, write and implement the following concepts: Inheritance, Interfaces, Packages, Strings and Collections.
- Understand and write programs on Exception Handling, I/O, and Multithreading.
- Understand and implement applications using Applets, AWT, Swings and Events.

Course Outcomes: Students will be able to

CO1 Demonstrate OOP concepts, its advantages over structured programming.
CO2 Develop and implement Inheritance, polymorphism.
CO3 Analyze Exception Handling, Multithreading, I/O.
CO4 Create code for Event Handling, Applets, AWT and Swings.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO2	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO3	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO4	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3

LIST OF EXPERIMENTS

1. Write a Java program to declare, initialize and accessing the elements of Single dimensional Arrays, Multidimensional Arrays.
2. Write a Java program to demonstrate recursion.
3. Write a Java program to demonstrate static member, static method and static block.
4. Write a Java program to demonstrate method overloading and method overriding using simple inheritance.
5. Write a Java program to demonstrate multiple inheritance using interfaces.
6. Write a Java program to demonstrate packages.
7. Write a Java program to demonstrate String class methods.
8. Write a Java program to create user defined exception class, use couple of built-in Exception classes.
9. Write a Java program to demonstrate inter-thread communication.
10. Write an Applet program to demonstrate passing parameters to Applet, Graphics, Color and Font classes.
11. Write a Java program to demonstrate handling Action events, Item events, Key events, Mouse events, Mouse Motion events.

12. Write a GUI application which uses the following AWT components Label, Text Field, Text Area, Checkbox, Checkbox Group, Button.
13. Write a GUI application using JTable, JTree, JCombo Box.

Text Books:

1. "Java The Complete Reference", 9th Edition, Herbert Schildt, TMH Publishing Company Ltd, New Delhi, 2014.

References:

1. "Big Java ", 4th Edition, Cay Horstman, John Wiley & Sons, 2009.
2. "Java How to Program (Early Objects)", H. M. Dietel and P. J. Dietel, 11th edition Pearson Education, 2018.

Professional Ethics & Human Values

II B. Tech. – III Semester (Code: 20DS306/MC02)

Lectures:	2 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	00	Credits:	--

Pre-Requisite: None.

Course Objectives: Students will be able to

- Comprehend a specific set of behavior and values any professional must know and must abide by, including confidentiality, honesty and integrity. Understand engineering as social experimentation.
- Know, what are safety and Risk and understand the responsibilities and rights of an engineer such as collegiality, loyalty, bribes/gifts.
- Recognize global issues visualizing globalization, cross-cultural issues, computer ethics and also know about ethical audit
- Discuss case studies on Bhopal gas tragedy, Chernobyl and about codes of Institute of Engineers, ACM

Course Outcomes: Students will be able to

CO1	Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field and the multiple ethical interests at stake in a real-world situation or practice
CO2	Articulate what makes a particular course of action ethically defensible, Assess their own ethical values and the social context of problems.Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data.
CO3	Demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work integrate, synthesize, and apply knowledge of ethical dilemmas and resolutions in academic settings, including focused and interdisciplinary research
CO4	Participate in the discussion of the case studies like bhopal gas tragedy,Chernobyl disasters.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	-	-	-	-	-	3	3	3	-	-	-	3	-	-	-
CO2	-	-	-	-	-	3	3	3	-	-	-	3	-	-	-
CO3	-	-	-	-	-	3	3	3	-	-	-	3	-	-	-
CO4	-	-	-	-	-	3	3	3	-	-	-	3	-	-	-

UNIT-1 (12 hours)

Human Values: Morals, Values and Ethics, Integrity, Work Ethics, Service and Learning, Civic Virtue, Respect for Others, Living Peacefully, Caring and Sharing, Honesty, Courage, Value Time, Cooperation, Commitment and Empathy, Spirituality, Character.

Engineering Ethics: History of Ethics, Engineering Ethics, Consensus and Controversy, Profession and Professionalism, Professional Roles of Engineers, Self Interest, Customs and Religion, Uses of Ethical Theories, Professional Ethics, Types of Inquiry, Kohlberg's Theory, Gilligan's Argument, Heinz's Dilemma.

Engineering as Social Experimentation: Comparison with Standard Experiments, Knowledge Gained, Conscientiousness, Relevant Information, Learning from the Past, Engineers as Managers,

Consultants, and Leaders, Accountability, Roles of Codes, Codes and Experimental Nature of Engineering.

UNIT-2 (11 hours)

Engineers' Responsibility for Safety and Risk: Safety and Risk, Types of Risks, Safety and the Engineer, Designing for Safety, Risk-Benefit Analysis, Accidents.

Responsibilities and Rights: Collegiality, Two Senses of Loyalty, Obligations of Loyalty, Misguided Loyalty, Professionalism and Loyalty, Professional Rights, Professional Responsibilities, Conflict of Interest, Self-interest, Customs and Religion, Collective Bargaining, Confidentiality, Acceptance of Bribes/Gifts, Occupational Crimes, Whistle Blowing.

UNIT-3 (12 hours)

Global Issues: Globalization, Cross-cultural Issues, Environmental Ethics, Computer Ethics, Weapons Development, Ethics and Research, Analyzing Ethical Problems in Research, Intellectual Property Rights (IPRs).

Ethical Audit: Aspects of Project Realization, Ethical Audit Procedure, The Decision Makers, Variety of Interests, Formulation of the Brief, The Audit Statement, The Audit Reviews.

UNIT-4 (12 hours)

Case Studies: Bhopal Gas Tragedy, The Chernobyl Disaster.

Appendix 1: Institution of Engineers (India): Sample Codes of Ethics.

Appendix 2: ACM Code of Ethics and Professional Conduct.

Text Books:

1. "Professional Ethics & Human Values", M.GovindaRajan, S.Natarajan, V.S.SenthilKumar, PHI Publications 2013.

References:

1. "Ethics in Engineering", Mike W Martin, Ronald Schinzinger, TMH Publications.

Mathematical Foundations for Data Science

II B. Tech. IV Semester 20DS401/MA06

Lectures:	2 Hours/week	Tutorial:	1 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: None.

Course Objectives: Students will be able to

- Compute various measures of central tendency, dispersion, skewness, kurtosis and interpret them.
- Learn about elementary nonparametric testing procedures and use them for analyzing real data for drawing statistical inferences and also are able to design, use and interpret control charts for both variables and attributes.
- Model competitive real-world phenomena using concepts from game theory, analyze pure and mixed strategies
- Select best strategy from various alternatives of decision making under uncertainity Conditions using different criterion for uncertainity and also can apply dynamic programming approach to real world problems wherever applicable

Course Outcomes: Students will be able to

CO1 Analyse the whole idea on a frequency distribution with the help of measures of central tendency, measures of dispersion, skewness and kurtosis.

CO2 Adapt nonparametric testing procedures for drawing statistical inferences in data analysing problems and Construct Quality control chats for variables and attributes.

CO3 Solve Games with/without saddle points using algebraic method, graphical method and principle of dominance for achieving optimum best mixed strategies.

CO4 Utilize dynamic programming algorithm to solve real world problems and choose appropriate decision under uncertainty conditions

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO-1	3	2	2	-	-	-	-	-	-	-	-	2	-	2	-
CO-2	3	2	3	-	-	-	-	-	-	-	-	2	-	3	-
CO-3	2	2	2	-	-	-	-	-	-	-	-	2	-	2	-
CO-4	2	2	2	-	-	-	-	-	-	-	-	2	-	2	-

UNIT-1 12 Hours

Descriptive Statistics: Mean, Median, Mode, Range, Standard Deviation.

Measures of central tendency: Arithmetic mean, median and mode

Measures of dispersion: Dispersion, measures of dispersion, range, quartile deviation, mean deviation, standard deviation and root mean square deviation, Moments, skewness, kurtosis.

(Sections: 2.3, 2.5, 2.6, 2.7, 3.1, 3.3, 3.4, 3.5, 3.6, 3.7, 3.7.1, 3.7.2, 3.9, 3.9.1, 3.13, 3.14 of Text Book 1)

UNIT-2 12 Hours

Non-Parametric Tests: Introduction**,** Sign test, Rank-sum test, Correlation based on ranks, tests of randomness, Kolmogorov Smirnov and Anderson-Darling tests.

Statistical Quality Control: Quality control, Control charts for measurements, Control charts for attributes, Tolerance limits.

(Sections: 14.1, 14.2, 14.3, 14.4, 14.5, 14.6, 15.4, 15.5, 15.6, 15.7 of Text Book 2)

UNIT-3 12 Hours

GAMES AND STRATEGIES: Introduction; Two-person Zero –Sum Games; Some Basic terms; The Maximin-Minimax Principle; Games Without Saddle Points-Mixed Strategies; Graphic Solution of 2xn and mx2 games; Dominance Property.
(Sections:17.1, 17.2, 17.3, 17.4, 17.5, 17.6, 17.7 of Text Book 3)

UNIT-4 12 Hours

Decision Analysis: Introduction, Decision making problem, Decision-making process, Decision-making environment, Decisions under uncertainty.
DYNAMIC PROGRAMMING: Introduction; The Recursive Equation Approach, Characteristics of Dynamic Programming; Dynamic Programming Algorithm.
(Sections: 16.1, 16.2, 16.3, 16.4, 16.5, 13.1, 13.2, 13.3, 13.4 of Text Book 3)

Text Books :
1. Fundamentals of Mathematical Statistics, S.C. Gupta and V.K. Kapoor, 10^{th} edition.
2. Probability and Statistics for Engineers, Richard A. Johnson, 8th edition, PHI.
3. Operations Research, Kanti Swaroop, P.K. Gupta, Manmohan, 13th edition, Sultan Chand & Sons. 2007.

References :
1. ErwinKreyszig, "Advanced Engineering Mathematics", 9th edition, John Wiley & Sons.
2. N.P.Bali and M.Goyal, "A Text book of Engineering Mathematics" Laxmi Publications, 2010.
3. R.E Walpole, R.H. Myers & S.L. Myers 'Probability & Statistics for Engineers and Scientists', 6^{th} Edition, PHI.
4. Murray R Spiegel, John J.Schiller, R. AluSrinivasa, 'Probability &Satistics', Schaum's outline series.

Web Technologies

II B. Tech. – IV Semester (Code: 20DS402/CC09)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: None.

Course Objectives: Students will be able to

- Know elements and tags of HTML and apply Styles using Cascading Style Sheets.
- Know basics of Java Script, Functions, Events, Objects and Working with browser objects.
- Know basics of XML, DOM and advanced features of XML.
- To convert XML documents into other formats and XSLT.

Course Outcomes: Students will be able to:

CO1	Analyze a web page and identify its elements and attributes
CO2	Create web pages using XHTML and Cascading Styles sheets.
CO3	Build dynamic web pages using JavaScript (client side programming). Students will be able to write a well formed / valid XML documents
CO4	Understand Web server and its working. Design and implement a client server internet application that accommodates specific requirements and constraints.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	-	3	-	3	-	-	-	-	-	-	3	3	-	3
CO2	3	-	3	-	3	-	-	-	-	-	-	3	3	-	3
CO3	3	-	3	-	3	-	-	-	-	-	-	3	3	-	3
CO4	3	-	3	-	3	-	-	-	-	-	-	3	3	-	3

UNIT-1 (12 hours)

HTML5: Fundamentals of HTML, Working with Text, Organizing Text in HTML, Working with Links and URLs, Creating Tables, Working with Images, Colors, and Canvas, Working with Forms.

UNIT-2 (12 hours)

CSS: Overview of CSS, Backgrounds and Color Gradients in CSS, Fonts and Text Styles, Creating Boxes and Columns Using CSS, Displaying, Positioning, and Floating an Element, List Styles, Table Layouts.

Dynamic HTML: Overview of JavaScript, JavaScript Functions, Events, Image Maps, and Animations.

UNIT-3 (12 hours)

Dynamic HTML (Cont..): JavaScript Objects, Working with Browser Objects, Working with Document Object.

Document Object Model: Understanding DOM Nodes, Understanding DOM Levels, Understanding DOM Interfaces- Node, Document, Element, Attribute.

UNIT-4 (12 hours)

XML: Working with Basics of XML, Implementing Advanced Features of XML, Working with XSLT.

AJAX: Overview of AJAX, Asynchronous Data Transfer with XML Http Request, Implementing AJAX Frameworks, Working with jQuery.

Text Books:

1. Kogent Learning Solutions Inc., HTML5 BlackBook: Covers CSS3, Javascript, XML, XHTML, Ajax, PHP and Jquery

References:

1. Harvey M.Deitel and Paul J. Deitel, "Internet &World Wide Web How to Program", 4/e, Pearson Education.
2. Jason Cranford Teague, "Visual Quick Start Guide CSS DHTML & AJAX", 4e, Pearson Education.
3. Tom Nerino Doli smith, "Java Script & AJAX for the web", Pearson Education2007.
4. Joshua Elchorn, "Understanding AJAX",PrenticeHall2006.

Database Management System

II B. Tech. – IV Semester (Code: 20DS403/CC10)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: None.

Course Objectives: Students will be able to

- Familiarize with fundamental concepts of database and various database architectures and Design relations for Relational databases using conceptual data modeling.
- Implement formal relational operations in relational algebra and SQL.
- Identify the Indexing types and normalization process for relational databases
- Use mechanisms for the development of multi user database applications.

Course Outcomes: Students will be able to

CO1 Ability to apply knowledge of database design methodology which give a good formal foundation in relational data model and Understand and apply the principles of data modeling using ER Model.

CO2 Familiar with relational DB theory and will able to write relational algebra expressions, Relational Calculus and SQL.for query

CO3 Design database schema and Identify and solve the redundancy problem in database tables using normalization.

CO4 Understand transaction processing, concurrency control and recovery techniques.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	3	3	3	-	-	-	-	-	-	-	3	3	2
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	3	3	-	-	-	-	-	-	-	-	3	3	2

UNIT-1 (12 hours)

Databases and Database Users: Introduction - An Example, Characteristics of the Database Approach, Actors on the Scene, Workers behind the Scene, Advantages of Using the DBMS Approach.

Database System Concepts and Architecture: Data Models, Schemas and Instances, Three-Schema Architecture and Data Independence, Database Languages and Interfaces, The Database System Environment, Centralized and Client/Server Architectures for DBMSs.

Data Modeling Using the Entity-Relationship (ER) Model : Using High-Level Conceptual Data Models for Database Design, An Example Database Application, Entity Types, Entity Sets, Attributes, and Keys - Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Types, Refining the ER Design for the COMPANY Database - ER Diagrams, Naming Conventions, and Design Issues

UNIT-2 (12 hours)

The Relational Algebra and Relational Calculus: Unary Relational Operations: SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, The Tuple Relational Calculus, The Domain Relational Calculus.

Schema Definition, Constraints, Queries, and Views : SQL Data Definition and Data Types, Specifying Constraints in SQL, Schema Change Statements in SQL, Basic Queries in SQL,INSERT, DELETE, and UPDATE Statements in SQL , Views (Virtual Tables) in SQL

UNIT-3 (12 hours)

Indexing Structures for Files: Types of Single-Level Ordered Indexes, Multilevel Indexes - Dynamic Multilevel Indexes Using B+-Trees.

Functional Dependencies and Normalization for Relational Databases: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys - General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form.

Relational Database Design Algorithms and Further Dependencies: Properties of Relational Decompositions -Lossless Join Decomposition and Dependency Preserving Decomposition, Multi-valued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form.

UNIT-4 (12 hours)

Introduction to Transaction Processing Concepts and Theory: Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, Characterizing Schedules Based on Recoverability, Characterizing Schedules Based on Serializability

Concurrency Control Techniques: Two-Phase Locking Techniques for Concurrency Control, Concurrency Control Based on Timestamp Ordering, Validation (Optimistic) Concurrency Control Techniques, Multiple Granularity.

Database Recovery Techniques: Recovery Techniques Based on Deferred Update, Recovery Techniques Based on Immediate Update, Shadow Paging.

Text Books:

1. Fundamentals of Database Systems, Ramez, Elmasri and Navathe Pearson Education, 6thedition

References:

1. Introduction to Database Systems, C.J. Date Pearson Education
2. Database Management Systems, Raghu Rama krishnan, Johannes Gehrke, TATA McGraw Hill3rdEdition
3. Database System Concepts, Silberschatz, Korth, McGraw hill,5thedition

Design and Analysis of Algorithms

II B. Tech. – IV Semester (Code: 20DS404/CC11)

Lectures:	2 Hours/week	Tutorial:	1 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Data Structures (20DS302)

Course Objectives: Students will be able to

- Understand about designing and effectiveness of an algorithm and applying of Master Theorem to find the complexity.
- Strengthen divide and conquer paradigms and know the optimal solution finding with the greedy method.
- Acquaintance of algorithm design strategies of Dynamic programming and easy know the major graph algorithms and their analyses.
- Get the ability to backtracking, branch with bound values and NP problems.

Course Outcomes: Students will be able to

CO1	Analyze the performance of algorithms through various strategies and apply the Master theorem to estimate the complexity of divide-and-conquer algorithms.
CO2	Apply the divide-and-conquer and greedy techniques to solve problems and perform complexity analysis.
CO3	Articulate on graph problems and identify the applicability of the dynamic-programming paradigm for designing solutions to problems.
CO4	Find all possible solutions for combinatorial and optimixation problems using Backtracking and Branch and Bound algorithms and also categorize the P and NP complex problems.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-
CO4	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-

UNIT-1 (12 hours)

Introduction: Algorithm, Pseudo code for expressing algorithms, Performance Analysis-Space complexity, Time complexity, Asymptotic Notation-Big Oh-notation, Omega notation, Theta notation and Little oh notation, Probabilistic analysis, Amortized analysis.

Master Theorem: Introduction, Generic Form- Case1, Case2, Case3, Inadmissible equations, Application to common algorithms.

UNIT-2 (12 hours)

Divide and conquer: General method, applications-Quicksort, Merge sort, Stassen's matrix multiplication.

Greedy method: General method, applications-Job sequencing with deadlines, Fractional knapsack problem, Minimum cost spanning trees-Prims, Kruskal, Single source shortest path problem-Dijkstra.

UNIT-3 (12 hours)

Dynamic Programming: General method, applications-0/1 knapsack problem, Travelling salesperson problem, Longest common sequence algorithm, Multi stage graphs using Forward& Backward approach, Reliability design.

Graph Applications: Graph traversals – Depth first, Breadth first, Bio Connected Components, Strongly Connected Components.

UNIT-4 (12 hours)

Backtracking: General method, applications-n-queen problem, sum of subsets problem. Branch and Bound: General method, applications- 0/1 knapsack problem-LC Branch and Bound solution.

NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP-Hardand NP Complete classes, Cook's theorem.

Text Books:

1. E. Horowitz, S.Sahniand S. Rajasekaran, "Fundamentals of Computer Algorithms",Galgotia Publication.

References:

1. T. H. Cormen, Leiserson, Rivestand Stein, "Introduction of Computer Algorithm", PHI.
2. SaraBasse, A.V.Gelder, "Computer Algorithms", Addison Wesley.

Technical English

II B.Tech – IV Semester (Code: 20DS405/EL02)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: None.

Course Objectives: Students will be able to

- At enhancing the vocabulary competency of the students
- To enhance the understanding of the elements of grammar
- To enable the students to use proper spelling, grammar in constructing the sentences
- To enhance the learner's ability to communicate accurately

Course Outcomes: Students will be able to

CO1 To comprehend the importance, barriers and strategies of listening skills in English.
CO2 To illustrate and impart practice Phonemic symbols, stress and intonation.
CO3 To practice oral skills and receive feedback on learners' performance.
CO4 To practice language in various contexts through pair work, role plays, group work and dialogue conversations

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	-	2	2	3	2	2	-	2	-
CO2	-	-	-	-	-	-	-	2	2	3	2	2	-	2	-
CO3	-	-	-	-	-	-	-	2	2	3	2	2	-	2	-
CO4	-	-	-	-	-	-	-	2	2	3	2	2	-	2	-

UNIT-1 (12 hours)

1.1 Vocabulary Development: Familiarizing Idioms &Phrases
1.2 Grammar for Academic Writing: Making Requests
1.3 Language Development: Using Transition & Link words
1.4 Technical Writing: Letter Writing &Email Writing

UNIT-2 (12 hours)

2.1 Vocabulary Development: Analogous words, Gender Sensitive language
2.2 Grammar for Academic Writing: Tenses: Simple Past /Present Perfect, The Future: Predicting &Proposing
2.3 Language Development: Cloze tests
2.4 Technical Writing: Technical Reports

UNIT-3 (12 hours)

3.1 Vocabulary Development: Abbreviations &Acronyms
3.2 Grammar for Academic Writing: Describing(People/Things/Circumstances) : Adjectival &Adverbial groups
3.3 Language Development: Transcoding (Channel conversion from chart to text)
3.4 Technical Writing: Circular, Memos, Minutes of Meeting

UNIT-4 (12 hours)

4.1 Vocabulary Development: Corporate vocabulary
4.2 Grammar for Academic Writing: Inversions &Emphasis

4.3 Language Development: Reading Comprehension
4.4 Technical Writing: Resume Preparation

References :

1. Communication Skills, Sanjay Kumar & Pushpa Latha. Oxford University Press: 2011.
2. Technical Communication Principles and Practice. Oxford University Press: 2014.
3. Advanced Language Practice, Michael Vince. Macmillan Publishers: 2003.
4. Objective English (Third Edition), Edgar Thorpe & Showick. Pearson Education: 2009
5. English Grammar: A University Course (Second Edition), Angela Downing Philip Locke, Routledge Taylor &Francis Group 2016

R Programming

II B.Tech – IV Semester (Code: 20DSL401/SOC2)

Lectures:	2 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3.5

Pre-Requisite: None

Course Objectives: Students will be able to

- Understand installation of R and installing packages. Understand writing R code for mathematical functions.
- Write R Code for importing and exporting data.
- Write R code to analyze data sets. Understand and write R code for graphs.
- Understand and write R code for statistical functions and Regression.

Course Outcomes: Students will be able to

CO1 Understand the Basics of R.Understand the installation of R langrage & installation of required packages. Write commands for mathematical calculations, vectors, Matrices, Data frames & Arrays. Write programs using functions.

CO2 Understand Reading data into R from csv files, excel files. Understand writing data from R environment to csv files, excel files. Understand create new variables, sorting merging dataset & manipulate data using SQL.

CO3 Analyze the data for various formats to see the data. Use various plots for visualization of data.

CO4 Understand statistics & linear models. Understand searching text patterns using regular expressions.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO2	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO3	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO4	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3

UNIT-1 (8 Hours)

Introduction to R: Why use R? Obtaining and installing R.
The R Environment: Command line interface, RStudio.
R Packages: Installing Packages, Loading packages, Building packages.
Basics of R: Basic Math, Variables, Data types, Vectors, Calling function, Function documentation, Missing data.
Advanced Data Structures: Data frames, Lists, Matrices and Arrays.

UNIT-2 (8 Hours)

Reading Data into R: Reading CSVs, Excel data.
Basic Data Management: A working example, Creating new variables, Recoding variables, Renaming variables, Missing values, Date values, Type conversion, Sorting data, Merging data set, Subsetting datasets, Using SQL statement to manipulate data.

UNIT-3 (8 Hours)

Advanced Data Management: A data management challenge, Numerical and character functions, A solution for data management challenge, Control flow, User written functions, Aggregate and reshaping.

Basic graphs: Bar plot, Pie chart, Histograms, Kernel Density plots, Box plots, Dot plots.

UNIT-4 (8 Hours)

Basic statistics: summary statistics, Correlation and covariance.

Manipulating Strings: Paste, Sprintf, Extracting text, Regular expressions.

Linear Models: Simple linear regression, Multiple linear regressions.

LIST OFEXPERIMENTS

1. a). Write R Code using R as a calculator.
   b). Write R Code on Vector Operation.
   c). Write R code which demonstrate i) Array ii) List iii) Matrix iv) stack v) Data Frames
2. Write R Code to Importing & Exporting data from i) CSV file ii) Excel file
3. Write R Code Which Demonstrate i) Missing Value Treatment ii) Outliers
4. Write R code which demonstrate i) Missing Values ii) Date Values iii) Type Conversion
5. Write R code to demonstrate character functions
6. Write R code which demonstrate functions and control loops
7. Write R code which demonstrate SQL operations using R
8. Write R code which demonstrate plotting of graphs i) Histogram ii) Pie Graph iii) Plot Graph iv) Box Plot v) Dot Plot vi) Kernel Density Plots
9. Write R code which demonstrate statistics functions i) Mean ii) Median iii) Range iv) Variance v) Co- variance
10. Write R code which demonstrates Linear Regression.
11. Write R code which demonstrates string operations

Textbooks:

1. R for Every One, Advanced analytics and graphics by Jared P Lander,Addison Wisley Data and analytics series. (UNIT-I, III)
2. R in Action, Data Analysis and graphics with R,Robert L Kabacoff, Manning Publisher (UNIT-II, IV)

References:

1. Beginning R by Dr. Mark Gardener, Wrox publisher.
2. Associate Analytics Facilitator Guide provided by NASSCOM. http://183.82.43.252/~gopam/html/NASSCOM

Web Technologies Lab

II B.Tech – IV Semester (Code: 20DSL402/CC12)

Lectures:	0 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	1.5

Pre-Requisite: None.

Course Objectives: Students will be able to

- Know elements and tags of HTML and apply Styles using Cascading Style Sheets.
- Know basics of Java Script, Functions, Events, Objects and Working with browser objects.
- Know basics of XML, DOM and advanced features of XML.
- To convert XML documents into other formats and XSLT.

Course Outcomes: Students will be able to

CO1 Analyze a web page and identify its elements and attributes

CO2 Create web pages using XHTML and Cascading Styles sheets.

CO3 Build dynamic web pages using JavaScript (client side programming). Students will be able to write a well formed / valid XML documents

CO4 Understand Web server and its working. Design and implement a client-server internet application that accommodates specific requirements and constraints.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	3	-	3	-	-	2	-	2	-	3	3	-	-
CO2	3	-	3	-	3	-	-	2	-	2	-	3	3	-	-
CO3	3	-	3	-	3	-	-	2	-	2	-	3	3	-	-
CO4	3	-	3	-	3	-	-	2	-	2	-	3	3	-	-

LIST OF EXPERIMENTS

1. Write HTML5 document to design a webpage. (Using all fundamental elements, Organizing text, Links, URLs and Tables).
2. Write HTML5 document to design a webpage. (Using Images, Colors, Canvas & Forms).
3. Write codes for different types of styles in CSS3.
4. Write java scripts covering Function, Arrays and Events.
5. Demonstrate JavaScript objects.
6. Demonstrate browser objects.
7. Demonstrate Document Object Model for an HTML document.
8. Write well-formed and valid XML documents.
9. Write code for converting XML document to HTML using XSLT.
10. Build a webpage using JQuery and its components.

Text Books:

1. Kogent Learning Solutions Inc.,HTML5 BlackBook: Covers CSS3, Javascript, XML, XHTML, Ajax, PHP and Jquery.

References:

1. Harvey M. Deitel and Paul J.Deitel, "Internet &World Wide Web How to Program", 4/e, Pearson Education.
2. Joshua Elchorn, "Understanding AJAX", Prentice Hall 2006.

RDBMs Lab

II B.Tech – IV Semester(Code: 20DSL403/CC13)

Lectures:	0 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	1.5

Pre-Requisite: None.

Course Objectives: Students will be able to

- Analyze the student on database languages.
- Interpret the Knowledge on database design.
- Determine the knowledge on key constraints and Normalization.
- Determine the knowledge on procedures and functions.

Course Outcomes: Students will be able to:

CO1 Design database by using ER Diagrams
CO2 Implement DDL, DML, DCL Commands using SQL.
CO3 Apply key constrains to get a normalized database.
CO4 Implement procedures and functions using PL/SQL

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	3	-	-	2	-	2	-	3	3	3	3
CO2	3	3	3	3	3	-	-	2	-	2	-	3	3	3	3
CO3	3	3	3	3	3	-	-	2	-	2	-	3	3	3	3
CO4	3	3	3	3	3	-	-	2	-	2	-	3	3	3	3

List of Experiments

Experiment 1: Working with ER Diagram

Example: ER Diagram for Sailors Database

Entities	Relationship	Primary Key Attributes
Sailor	Reserves	SID (Sailor Entity)
Boat		BID (Boat Entity)

Experiment 2: Working with DDL, DML, DCL and Key Constraints

Creation, Altering and Dropping of Tables and Inserting Rows into a Table (Use Constraints While Creating Tables) Examples Using Select Command.

Experiment 3: Working with Queries and Nested QUERIES

Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints

Experiment 4: Working with Queries USING Aggregate Operators & views

Queries using Aggregate Functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and Dropping of Views

Experiment 5: Working with Conversion Functions & String Functions

Queries using Conversion Functions (TO_CHAR, TO_NUMBER AND TO_DATE), String Functions (CONCATENATION, LPAD, RPAD, LTRIM, RTRIM, LOWER, UPPER, INITCAP, LENGTH, SUBSTR AND INSTR), Date Functions (SYSDATE, NEXT_DAY, ADD_MONTHS,

LAST_DAY, MONTHS_BETWEEN), LEAST, GREATEST, TRUNC, ROUND, TO_CHAR, TO_DATE

Experiment 6: Working with LOOPS using PL/SQL
Program Development using WHILE LOOPS, FOR LOOPS, Nested Loops using ERROR Handling.

Experiment 7: Working with Functions Using PL/SQL
Program Development using Creation of Stored Functions, Invoke Functions in SQL Statements and Write Complex Functions.

Experiment 8: Working with Stored Procedures
Programs Development using Creation of Procedures, Passing Parameters IN and OUT of PROCEDURES

Experiment 9: Working with CURSORS
Develop Programs using Features Parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of Clause and CURSOR Variables.

Experiment 10: Working with Triggers using PL/SQL
Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers

Text Books:

1. Oracle PL/SQL by Example, Benjamin Rosenzweig, Elena Silvestrova, Pearson Education 3rdEd
2. Oracle Database Logic PL/SQL Programming, ScottUrman, TataMc-Graw Hill.
3. SQL and PL/SQL for Oracle 10g, Black Book, Dr.P.S.Deshpande

Automata Theory & Formal Languages

III B.Tech - V Semester (Code: 20DS501/CC14)

Lectures:	2 Hours/week	Tutorial:	1 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Discrete Mathematics (20DS205)

Course Objectives: The student will be able to

- Understand the theory of automata and formal languages. Construct finite automata, and conversion between DFA and NFA.
- Demonstrate the connection between regular expressions, languages, and finite automata
- Demonstrate the connection between pushdown automata and context-free languages and Context Free Grammars.
- Construct Turing machines for a given task. Understand undecidability problems about Turing Machine and post correspondence problem (PCP).

Course Outcomes: Students will be able to

CO1 Comprehend automata and its uses. Create a finite automata and switch between implementations that are deterministic and nondeterministic.

CO2 Transform finite automata into regular expressions and the other way around. Make a DFA that is minimal.

CO3 Build push-down automata for several context-free languages. Explain how PDA and context-free grammars are related.

CO4 Design Turing machines for different languages. Learn about TM and post correspondence problems that are undecidable and undecidable.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	-	-	-	-	-	-	-	-	-	2	2	-
CO2	2	2	2	-	-	-	-	-	-	-	-	-	2	2	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	2	2	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-	2	2	-

UNIT-I

12 Hours

Automata: Why Study Automata Theory, The central concepts of automata theory - Alphabets, Strings, Languages, Problems.

Finite Automata: An Informal picture of finite automata, Deterministic finite automata (DFA) - Definition of DFA, DFA processing strings, Notations for DFA, Extended transition function, the language of DFA, Non deterministic finite automata (NFA) – Definition ofNFA, Extended transition function, the language of NFA, Equivalence of DFA and NFA.

Automata with ϵ transitions: Use of ϵ - transition, notation for an ϵ - NFA, Epsilon closures, extended transitions and languages, Eliminating ϵ - transitions.

UNIT-2

12 Hours

Regular Expressions and Languages: Regular expressions, finite automata and regular expressions, Algebraic laws of regular expressions.

Properties of Regular Languages: Proving languages are not regular – Pumping lemma for regular languages, Applications of the pumping lemma, Closure Properties of Regular Languages, Equivalence and minimization of automata – Minimization of DFA.

UNIT-3 12 Hours

(Construction based treatment & proofs are excluded)

Context Free Grammars: Context Free Grammars, Parse Trees, ambiguous grammars. **Pushdown Automata:** Definition of the Pushdown automata, the languages of PDA, Equivalences of PDA‘s and CFG‘s.

Context free languages: Normal form‘s for context- Free grammars, the pumping lemma for context free languages.

UNIT-4 12 Hours

Properties of Context free languages: closure properties for context free languages, Decision properties for CFL‘s.

Introduction to Turing Machines: The Turing Machine, programming techniques for Turing machines.

Undecidability: a language that is not recursively enumerable, an undecidable problem that is RE, Undecidability problems about TM, Post‘s Correspondence problem.

Text Books :

1. John E.Hopcroft, Rajeev Motwani, & Jeffery D. Ullman, “Introduction to Automata Theory Languages and Computations”, Pearson Education, 2008, Third Edition, ISBN: 978-8131720479.

References :

1. KLP Mishra & N.Chandrasekharan, -“Theory of Computer Science: Automata, Languages and Computation”, PHI, 2006, Third Edition, ISBN: 978-8120329683.
2. H.R.Lewis, C.H.Papadimitriou, ―“Elements of The theory of Computation“, Pearson Education, 2015, Second Edition, ISBN: 978-93-325-4989-0.

Computer Networks

III B. Tech. – V Semester (Code: 20DS502/CC15)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Operating Systems (20DS304)

Course Objectives: Students will be able to

- Understand the basic concepts of data communication, layered model, protocols and OSI&TCP layers
- Understand the basic concepts of Data Link control, Network Layer Design Issues, Routing Algorithms & Congestion.
- Understand the basic concepts of Quality of service, Network Layer & Transport Layer
- Understand the basic concepts of TCP, UDP & Application Layer

Course Outcomes: Students will be able to

CO1 Understand the fundamentals of networks, network reference models and various error correction and detection techniques in data communication.

CO2 Analyze error control; flow control mechanisms used at data link layer and various routing and congestion control protocols in network design.

CO3 Understand the basic principles of OPV4 and its addressing mechanisms, elements of transport protocols in transport layer.

CO4 Analyze the underlying protocols in transport layer and application layer.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-	3
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3	-	3
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	-	3
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	-	3

UNIT-1 12 Hours

Data Communications & Networking Overview: A Communications Model, Data Communications, Data Communication Networking.

Protocol Architecture: The Need for a Protocol Architecture, A Simple Protocol Architecture, OSI, The TCP/IP Protocol Architecture.

Digital Data Communication Techniques: Asynchronous & Synchronous Transmission, Types of Errors, Error Detection, Error Correction.

UNIT-2 12 Hours

DATA Link Control: Flow Control, Error Control.

Network Layer: Network Layer Design Issues: Store-and-Forward Packet Switching, Services Provided to the Transport Layer, Implementation of Connectionless Service, Implementation of Connection-Oriented Service, Comparison of Virtual-Circuit & Datagram Subnets.

Routing Algorithms: The Optimality Principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing.

Congestion Control Algorithms: General Principles of Congestion Control, Congestion Prevention Policies, Congestion Control in Virtual-Circuit Subnets, Congestion Control in Datagram Subnets, Load Shedding, Jitter Control.

UNIT-3 12 Hours

Quality of Service: Requirements, Techniques for Achieving Good Quality of Service The Network Layer in the Internet: The IP Protocol, IP Addresses, Internet Control Protocols. The **Transport Layer, The Transport Service:** Services Provided to the Upper Layers, Transport Service Primitives, Berkeley sockets

Elements of Transport Protocols: Addressing, Connection Establishment, Connection Release, Flow Control and Buffering, Multiplexing, Crash Recovery.

UNIT-4 12 Hours

The Internet Transport Protocol (UDP): Introduction to UDP, Remote Procedure Call, The Real-Time Transport Protocol.

The Internet Transport Protocols (TCP): Introduction to TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release, Modeling TCP Connection Management, TCP Transmission Policy, TCP Congestion Control, TCP Timer Management.

Application Layer: The Domain Name System (DNS): The DNS Name Space, Resource Records, Name Servers.

Text Books :

1. Behrouz A.Forouzan, "Data Communications and Networking", 4th edition, TMH.
2. Tanenbaum,"Computer Networks",5th Edition, Pearson Education, 2011

References :

1. Wayne Tomasi, "Introduction to Data Communications and Networking", PHI.
2. Behrouz A.Forouzan, "Data Communications and Networking", Fourth edition, TMH
3. God Bole, "Data Communications & Networking", TMH.
4. Kurose & Ross, "COMPUTER NETWORKS– A Top-down approach featuring the Internet", Pearson Education, AlbertoLeon, Garciak.
5. Leon Gartia, Indra Widjaja, "Communication Networks Fundamental Concepts and Key Architectures", TMH.
6. Nader F.Mir, "Computer and Communication Networks", PHI.

Software Engineering

III B.Tech – V Semester (Code: 20DS503/CC16)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: None.

Course Objectives: Students will be able to

- Understand different process models of Software Engineering
- Understand Agile Software Development. How to collect requirements from client and how to analyze the collected requirements
- Understand how to design and implement the Software Product or Project.
- Understand the concepts of Testing and Measuring the software project or Product

Course Outcomes: Students will be able to

CO1 Recognize the many generic and agile process models.
CO2 Choose appropriate process model depending on the user requirements.
CO3 Develop different design models for the software project.
CO4 Distinguish various testing techniques, software metrics, and measures.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	-	3	-	-	-	-	-	-	3	3	2	3
CO2	3	3	3	-	3	-	-	-	-	-	-	3	3	2	3
CO3	3	3	3	-	3	-	-	-	-	-	-	3	3	2	3
CO4	3	3	3	-	3	-	-	-	-	-	-	3	3	2	3

UNIT-1 12 Hours

Introduction to Software Engineering: The Evolving Role of Software, Software, the Changing Nature of Software, Legacy Software, Software Myths.

A Generic View of Process: Software Engineering - A Layered Technology, a Process Framework, the CMMI, Process Patterns, Process Assessment, Personal and Team Process Models, Product and Process.

Process Models: Prescriptive Models, the Waterfall Model, Incremental Process Models, Evolutionary Models, the Unified Process.

UNIT-2 12 Hours

An Agile View of Process: What Is Agility? , What Is an Agile Process? , Agile Process Models.

Requirements Engineering: A Bridge To Design and Construction, Requirements Engineering Tasks, Initiating the Requirements Engineering Process, Eliciting Requirements, Developing Use-cases, Building the Analysis Model, Negotiating Requirements, Validating Requirements.

Building the Analysis Model: Requirements Analysis, Analysis Modeling Approaches, Data Modeling Concepts, Flow-Oriented Modeling, Class Based Modeling Creating a Behavioral Model.

UNIT-3 12 Hours

Design Engineering: Design within the Context of Software Engineering, Design Process and Design Quality, Design Concepts The Design Model, Pattern Based Software Design.

Creating an Architectural Design: Software Architecture, Data Design, Architectural Styles and Patterns, Architectural Design, Assessing Alternative Architectural Designs.

Modeling Component-Level Design: What Is a Component? , Designing Class-Based Components, Conducting Component-Level Design, Designing Conventional Components.

Performing User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

UNIT-4 12 Hours

Software Process and Project Metrics: Introduction: Metrics Process and Project Domains, Software Measurement, Metrics for Software Quality, Integrating Metrics with Process.

Software Quality Assurance: Quality Concepts, Quality Movement, SQA, Software Reviews, Formal Technical Reviews, Formal Approaches to SQA, Software Reliability, ISO 9000 Quality Standards, SQA Plan.

Software Testing Strategies: Strategic Approach, Strategic Issues, Test strategies for Conventional Software, White box testing, Black Box testing, Test strategies for Object Oriented Software, Validation Testing, System Testing, The Art of Debugging.

Text Books :

1. Roger S.Pressman, "Software Engineering- A Practitioner's Approach", **McGraw Hill** , 2014, 8th. **McGraw Hill** ISBN- **978-0078022128**

References :

1. K.K. Aggarwal & Yogesh Singh, "Software Engineering", New Age International, 2008, Third Edition,. ISBN- **978-8122423600**
2. Pankaj Jalote, "An Integrated Approach to Software Engineering", Springer, 2005, Second Edition. ISBN- 978-0-387-20881-7
3. Ian Sommerville, "Software Engineering", Pearson Education, 2017, 10th Edition. ISBN-13: 978-9332582699
4. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, "Fundamentals of Software Engineering", PHI, 2002, Second Edition. ISBN - 978-8120322424
5. RajibMall, "Fundamentals of Software Engineering", PHI, 2018, 5thEdition, PHI. ISBN- 978-9388028028

Artificial Intelligence

(Professional Elective – I)

III B.Tech – V Semester (Code: 20DS504/PE1A)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Discrete Mathematics (20DS206), Data Structures(20DS302), Design & Analysis of Algorithms (20DS404),

Course Objectives: Students will be able to

- Understand the fundamental concepts of artificial intelligence, and their environment, various Search techniques
- Understand knowledge representation using predicate logic and rules
- Understand the planning techniques.
- Understand how to design and solve Learning techniques and Expert systems.

Course Outcomes: Students will be able to

CO1 Comprehend the underlying ideas of artificial intelligence, as well as their environment and different search methods.

CO2 Acquire the skills to describe knowledge using rules and predicate logic.

CO3 Comprehend the planning methods.

CO4 Comprehend the design and resolution of Expert and Learning systems.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	-	-	-	-	-	-	-	-	3	3	3	3
CO2	3	3	3	-	-	-	-	-	-	-	-	3	3	3	3
CO3	3	3	3	-	-	-	-	-	-	-	-	3	3	3	3
CO4	3	3	3	-	-	-	-	-	-	-	-	3	3	3	3

UNIT-1 12 Hours

Introduction to AI: What is AI? , Foundations of AI, History of AI, State of the Art.

Intelligent Agents: Agents and Environments, Good Behavior: Concept of Rationality, The Nature of Environments And The Structure of Agents.

Solving Problems by Searching: Problem Solving Agents, Searching for Solutions, **Uninformed Search Strategies:** Breadth First Search, Uniform Cost Search, Depth First Search, Iterative Deepening DFS and Bi-directional Search.

Informed (Heuristics) Search Strategies: Greedy BFS, A* Algorithm, AND-OR Search trees, **Constraint Satisfaction Problems:** Defining Constraint Satisfaction Problems, Local Search in CSP.

UNIT-2 12 Hours

Logical Agents: Knowledge Based Agents, The Wumpus World, Logic and Propositional Logic**,** **Propositional Theorem Proving:** Inference and proofs, Proof by resolution, Horn clauses and definite clauses, Forward and Backward chaining.

First Order Logic: Representation, Revisited Syntax and Semantics of First Order Logic, Using First Order Logic, Knowledge Engineering in First Order Logic.

Inferences in First Order Logic: Propositional vs. First Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.

UNIT-3 12 Hours

Knowledge Representation: Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information.

Slot and Filler Structures: Semantic Nets, Conceptual Dependency, Scripts. **Planning:** Overview - An Example Domain, The Blocks World, Component of Planning Systems, Goal Stack Planning, Hierarchical planning, Reactive systems.

UNIT-4 12 Hours

Learning: Introduction to learning, Rote learning, Learning by taking advice, Learning in problem solving, Learning from examples, Induction Learning, Explanation Based Learning. **Expert Systems:** Representing and using domain knowledge, Expert system shells, Explanation, Knowledge Acquisition.

Text Books :

1. Stuart Russel and Peter Norvig, Artificial Intelligence – A Modern Approach, 3rd Edition, Pearson Education/ PHI..
2. Elaine Rich & Kevin Knight, Artificial Intelligence, 3rd Edition, (TMH).

References :

1. Patrick Henry Winston. Artificial Intelligence. Pearson Education, 3 edition, 2007. ISBN 81317 15051
2. Saroj Kaushik. Artificial Intelligence. CENGAGE Learning, 1 edition, 2020. ISBN 9788131510995.

Data Warehousing & Data Mining

(Professional Elective – I)

III B.Tech – V Semester (Code: 20DS504/PE1B)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Database Management Systems (20DS403).

Course Objectives: Students will be able to

- Identify the scope and necessity of Data Warehousing & Mining for the society
- Understand importance of data, data preprocessing techniques to solve the real time problems
- Understand and implement classical models and algorithms in data warehouses and data mining.
- Develop skill in selecting the appropriate data mining algorithm for solving practical problems

Course Outcomes: Students will be able to

CO1 Recognize the extent to which data mining and warehousing are necessary for society.

CO2 Apply preprocessing strategies and classification models into practice, and hone your ability to choose the right preprocessing and classification algorithms.

CO3 Apply traditional models into practice and hone your ability to choose the best association rule mining algorithms.

CO4 Address issues in real time, put clustering models into practice and hone your abilities in analyzing suitable clustering techniques.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	3	-	-	-	-	-	-	2	3	3	2
CO2	3	3	3	3	3	-	-	-	-	-	-	2	3	3	2
CO3	3	3	3	3	3	-	-	-	-	-	-	2	3	3	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	3	3	2

UNIT-1 12 Hours

Data Warehouse and OLAP Technology: Introduction, A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation from Data Warehousing to Data Mining.

Data Mining: Introduction, Kinds of Data, Data Mining Functionalities, Classification of Data Mining Systems, Major Issues in Data Mining.

UNIT-2 12 Hours

Data Pre-processing: Importance of Data Process, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation.

Classification and Prediction: Introduction to Classification and Prediction, Issues Regarding Classification and Prediction, Classification by Decision Tree Induction - Decision Tree Induction, Attribute Selection Measures, Bayesian Classification.

UNIT-3 12 Hours

Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and a Road Map, Efficient and Scalable Frequent Item-set Mining Methods, Mining Various Kinds of

Association Rules, From Association Mining to Correlation Analysis, Constraint-Based Association Mining.

UNIT-4 12 Hours

Cluster Analysis: Introduction, Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods- k-Means and k-Medoids, Hierarchical Methods- Agglomerative and Divisive Hierarchical Clustering, Density-Based Methods- DBSCAN, Grid- Based Methods- STING, Outlier Analysis.

Text Books :
1. Jiawei Han Micheline Kamber – "Data Mining Concepts & Techniques", 2nd ed., Morgan Kaufmann Publishers.

References :
1. "Data Warehousing in the real world – A Practical guide for Building decision support systems", Sam Anahory, Dennis Murray, Pearson Education.
2. "Data Mining (Introductory and Advances Topics)", Margaret H. Dunham, Pearson Education.

Parallel Algorithms

(Professional Elective – I)

III B.Tech – V Semester (Code: 20DS504/PE1C)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Design & Analysis of Algorithms (20DS404),

Course Objectives: Students will be able to

- Realize the use basic sequential algorithms and Describe about basic parallel algorithms.
- Describe and use basic data structures; know about the existence of advanced data structures.
- Describe and use the main design techniques for sequential algorithms
- Analyze message-passing based parallel algorithms in C using the MPI library.

Course Outcomes: Students will be able to

CO1 Elucidate the parallel computing models, and differentiate between sequential and parallel algorithms.

CO2 Analyze the parallel algorithms for CRCW, CREW, EREW models.

CO3 Identify the correctness and analyze the computational complexity of sequential algorithms.

CO4 Differentiate among several algorithms solving the same problem under different conditions.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-
CO4	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-

UNIT-1 12 Hours

Introduction to Parallel Algorithms: Models of Computation – Analyzing Algorithms, Selection-The Problem and a lower Bound, A Sequential algorithm, Desirable Properties of Parallel algorithm, An algorithm for parallel Selection.

Merging: A Network for Merging, Merging on the CREW and EREW Models – A better Algorithm for the EREW model.

UNIT-2 12 Hours

Sorting: A network for Sorting, sorting on a Linear Array, Sorting on CRCW, CREW, EREW Models

Searching: Searching a Sorted Sequence – Searching a Random Sequence, Searching on a tree, searching on Mesh.

UNIT-3 12 Hours

Generating Permutations and Combinations: Sequential Algorithms, generating permutations in Parallel, generating combinations in Parallel.

Matrix Operations: Transpositions, Matrix by Matrix Multiplications, Matrix by Vector multiplication.

UNIT-4 12 Hours

Graph Theory: Computing the Connectivity Matrix, Finding Connected Components, All Pairs Shortest Paths, Computing Minimum Spanning Trees.
Applications: Job Sequencing with Deadlines, Knapsack Problem.

Text Books :
1. Selim G. Akl, The Design and Analysis of Parallel Algorithms, Prentice Hall, New Jersey, 1989.

References :
1. Michael J. Quinn, Parallel Computing: Theory & Practice, Tata McGraw Hill Edition, 2003.
2. Justin R. Smith, the Design and Analysis of Parallel Algorithms, Oxford University Press, USA, 1993.
3. Joseph JaJa, Introduction to Parallel Algorithms, Addison-Wesley, 1992.

Enterprise Programming

(Job Oriented Elective – I)

III B.Tech – V Semester (Code: 20DS505/JO1A)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Object Oriented Programming(20DS303), Web Technologies(20DS402)

Course Objectives: Students will be able to

- Develop an application using servlets and JDBC
- Design an application using JSP and JSF
- Create an application on web services and web sockets.
- Code an enterprise application using EJBs and Persistence API

Course Outcomes: Students will be able to

CO1 Understand J2EE as an architecture and platform for building and deploying web-based enterprise applications. Learn how to build database-driven, Web applications using Java. Demonstrate the functionality of Java Servlets.

CO2 Demonstrate the functionality of JSP and JSF applications

CO3 Develop Web Service and Socket applications.

CO4 Understand the EJB architecture and have a good grasp on when to use and how to use various EJB bean types and acquire relevant Java programming experience.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	3	-	3	-	-	-	-	-	-	2	3	3	3
CO2	3	2	3	-	3	-	-	-	-	-	-	2	3	3	3
CO3	3	2	3	-	3	-	-	-	-	-	-	2	3	3	3
CO4	3	2	3	-	3	-	-	-	-	-	-	2	3	3	3

UNIT-1 12 Hours

The Big Picture: Java EE Architecture, The Many Variations of Java EE Applications, Packaging and Deploying the Java EE Application, Java EE Platform and Implementations.

Classic Memories - JDBC: Introduction to JDBC, Structured Query Language, The JDBC APIs.

Java Servlets and Web Applications - Foundations of the Web Tier: The HTTP Protocol, Introducing Java Servlets, Understanding the Java Servlet API, Web Applications, Java Servlets: The Good and the Bad.

UNIT-2 12 Hours

Dynamic Web Pages - JSP: JSP Runtime Architecture, JSP Syntax, The Java Environment for JSPs, JSP Standard Tags, Custom Tag Libraries, Expression Language.

Assembling Dynamic Web Pages - JavaServer Faces: Architecture of a JSF Application, JavaServer Faces Tags, Java EE Managed Beans, f: Core Tags, JSTL Core Tags, Extensibility and Modularity.

UNIT-3 12 Hours

Web Sites for Non-browsers - JAX-RS: What Are RESTful Web Services, The Java API for RESTful Web Services, Deploying JAX-RS Resources, Content Production, Content

Consumption, Accessing Web Service Context, Exception Mapping, Number of Instances of Resource Classes, Path Mapping.

JSON Processing : Streaming API : Consuming JSON Using the Streaming API, Producing JSON Using the Streaming API; **Object Model API :** Consuming JSON Using the Object Model API , Producing JSON Using the Object Model API.

Adding Sparkle - Java WebSockets: Introduction to the WebSocket Protocol, The WebSocket Lifecycle, Overview of the Java WebSocket API, Java WebSocket Encoders and Decoders, Message Processing Modes, Path Mapping, Deployment of Server Endpoints.

UNIT-4 12 Hours

The Fundamentals of Enterprise Beans: Introduction to Enterprise Beans, Hello Enterprise Beans, Flavors of Enterprise Beans, Exposing Enterprise Beans, Finding Enterprise Beans, EJB Lifecycle, Packaging Enterprise Beans.

Advanced Thinking with Enterprise Beans: Multi-threading and Enterprise Beans, Asynchronous Enterprise Beans, Enterprise Bean Contexts, The Timer Service, Transactions and Enterprise Beans, Interceptors.

Modern Memories - The Java Persistence API: Persistence Entities, The Entity Manager, Java Persistence Query Language, Configuring JPA Applications.

Text Books :
1. Dr. Danny Coward, “Java EE 7: The Big Picture”, oracle press.
2. Arun Gupta “Java EE 7 Essentials” O’Reilly.

References :
1. Antonio Goncalves “Beginning Java EE 7” Apress.

Middleware Technologies

(Job Oriented Elective – I)

III B.Tech – V Semester (Code: 20CS505/JO1B)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Object Oriented Programming(20DS303), Web Technologies(20DS402)

Course Objectives: Students will be able to

- Understand the operations of HTML & Web controls with tracing.
- Apply styles using validation controls and rich controls by applying state management
- Do operations on the database with ADO.NET fundamentals and format the data with data controls
- Learn the framework, working with web services by following MVC

Course Outcomes: At the end of the course students will be able to

CO1 Interpret the operations of HTML & Web controls with tracing.

CO2 Implement styles using validation controls and rich controls by applying state management.

CO3 Operate the database with ADO.NET fundamentals and format the data with data controls.

CO4 Discuss framework, working with web services by following MVC.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3	-	3	-	-	-	-	-	-	2	3	3	3
CO2	3	2	3	-	3	-	-	-	-	-	-	2	3	3	3
CO3	3	2	3	-	3	-	-	-	-	-	-	2	3	3	3
CO4	3	2	3	-	3	-	-	-	-	-	-	2	3	3	3

UNIT-I

12 Hours

The .NET Framework: C#, VB, and the .NET Languages, Intermediate languages, Common language runtime, the .NET class library.

Web Form Fundamentals: Understanding the anatomy of an ASP.NET application, Introducing server controls, improving the currency converter, taking a deeper Look at HTML control classes, using the page class, using Application events.

Web Controls: Stepping up to web controls, web control classes, List controls, Table controls, Web control events and AutoPost Back, An interactive web page.

Tracing: Enabling Tracing, Writing Trace Information, Performing Application-Level Tracing.

UNIT-II

12 Hours

State Management: Understanding the problem of the state, using View State, Transferring information between pages, using cookies, managing session state Configuring session state, using application state

Validation: understanding the validation, using the validation controls.

Rich Controls: The calendar, The Ad Rotator, pages with multiple views: Multiview, Wizard Control. Styles, Themes, and Master Pages: Styles, Themes, master page basics, advanced master pages.

UNIT-III 12 Hours

ADO.NET Fundamentals: Understanding databases, configuring your database, Understanding SQL basics, Understanding the data provider model, using direct data Access, using disconnected data access.

Data Binding: Introducing data binding, using single valued data binding, using repeated value data binding, working with data source controls.

The Data Controls: The grid view, formatting the gridview, selecting a grid view row, Editing with a grid view row, sorting and paging in gridview, using grid view templates The details view and form view.

UNIT-IV 12 Hours

LINQ and the Entity Framework: understanding LINQ, LINQ basics, using entity framework, Getting more advanced with entity framework, using the entity data source.

Working with Services: What is WCF Web Service, Application for Creating and Consuming a WCF Web Service?

Putting ASP.NET MVC in Context: Understanding the history of ASP.NET, Key Benefits of ASP.NET MVC.

Your First MVC Application: Preparing Visual Studio, Creating a new ASP.NET MVC Project, Rendering Web Page, Creating a simple Data Entry Application.

Text Book(s):

1. "Beginning ASP.NET 4.5 in C#", Matthew MacDonald, Apress Publishing Company.
2. "Professional ASP.NET 4.5 in C# and VB", Jason N. Gaylord, Christian Wenz , Pranav Rastogi, Todd Miranda, Scott Hanselman, John Wiley & Sons, Inc., Indianapolis, Indiana
3. "Pro ASP.NET MVC 5", Adam Freeman, Apress Publishing Company.

References:

1. "Microsoft Windows Communication Foundation Step by Step", john sharp, Microsoft Press.

Data Handling & Visualization

(Job Oriented Elective – I)

III B.Tech – V Semester (Code: 20DS505/JO1C)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: None

Course Objectives: Students will be able to

- Comprehend the prevalence of data and evolution of data visualization
- Handle data from various sources.
- Process data and missing values
- Plot various types of charts, graphs for data visualization

Course Outcomes: Students will be able to

CO1 Understand eras of data evolution and GESTALT's principles of visual perception.
CO2 Reading data from different data file formats using Python, Pandas package.
CO3 Perform filtering, reshaping, merging, sub-setting and filling null values using Pandas.
CO4 Draw scatter plot, pie charts, bar charts, bubble charts, distplots, swamplots, … using matplotlib, plotly and Seaborn.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1	3	-	3	-	-	-	-	-	-	1	3	3	3
CO2	1	1	3	-	3	-	-	-	-	-	-	1	3	3	3
CO3	1	1	3	-	3	-	-	-	-	-	-	1	3	3	3
CO4	1	1	3	-	3	-	-	-	-	-	-	1	3	3	3

UNIT-1 (12 Hours)

Introduction to Data Visualization - What is Data Visualization?, Evolution of Data Visualization, Why do We Need Data Visualization?, Difference between Data Visualization and Infographics, Principles of Gestalt's Theory of Visual Perception, Advantages of Data Visualization, Benefits of Data Visualization

Types of Digital Data - What is in Store?, Classification of Digital Data, Structured versus Unstructured Data

UNIT-2 (12 Hours)

Reading Data from Varied Data Sources into Python DataFrame - Read from Excel Data Source, Read Data from .csv, Load a Python Dictionary into a DataFrame, Reading JSON data into a Pandas DataFrame, Reading Data from Microsoft Access Database, Reading Data from .txt File, Reading Data from XML File

Pros and Cons of Charts - Pie Chart, Tree Map, Heat Map, Scatter Plot, Histogram, Word Cloud, Box Plot

Good Chart Designs - Mistakes That Can Be Avoided, Less Is More, Tables versus Charts

UNIT-3 (12 Hours)

Data Wrangling in Python - Pandas Data Manipulation**,** Dealing with Missing Values**,** Date Reshaping**,** Filtering Data**,** Merging Data**,** Subsetting DataFrames in Pandas**,** Reshaping the Data and Pivot Tables**,** Backfill**,** Forward Fill

Functions in Python Pandas- Pandas DataFrame Functions

UNIT-4 (12 Hours)

Matplotlib for Data Visualization - Exploratory Data Analysis using Python, Matplotlib
Plotly for Data Visualization - Plotly Python Package
Seaborn for Data Visualization - Seaborn Plots Using "iris" Dataset, Seaborn Plots Using "Superstore" Dataset, Seaborn Plots Using "OLYMPIC" Dataset, Seaborn Plots Using "Passengers Flights" Dataset.

Text Books:
1. Reimagining Data Visualization Using Python by Seema Acharya, Wiley india Publication 2021.

References:

Soft Skills

(Skill Oriented Course – III)

III B.Tech – V Semester(Code: 20DSL501/SOC3)

Lectures:	1 Hours/week	Tutorial:	0 Hours/week	Practical:	2 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	2

Pre-Requisite: None

Course Objectives: Students will be able to

- To make the engineering students aware of the importance, the role and the content of soft skills through instruction, knowledge acquisition, demonstration and practice
- To know the importance of interpersonal and intrapersonal skills in an employability setting
- Actively participate in group discussions / interviews and prepare & deliver Presentations
- Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, stress management and leadership quality.

Course Outcomes: Students will be able to

CO1 Use appropriate body language in social and professional contexts.

CO2 Demonstrate different strategies in presenting themselves in professional contexts.

CO3 Analyze and develop their own strategies of facing the interviews successfully.

CO4 Develop team coordinating skills as well leadership qualities.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	-	-	-	-	-	-	-	2	3	3	2	2	-	2	-
CO2	-	-	-	-	-	-	-	2	3	3	2	2	-	2	-
CO3	-	-	-	-	-	-	-	2	3	3	2	2	-	2	-
CO4	-	-	-	-	-	-	-	2	3	3	2	2	-	2	-

LIST OF EXPERIMENTS

1. Body Language & Identity Management

a. Facial Expressions – Kinesics - Occulesics
b. Haptics - Proxemics
c. Para Linguistics
d. Appearance
e. Identity Management Communication

2. Emotional Intelligence & Life Skills

a. Self Awareness through Johari Window and SWOC analysis
b. Self Motivation
c. Empathy
d. Assertiveness & Managing Stress
e. Positive Attitude
f. Time Management
g. Goal Setting: Short term, Long Term, Vision, Mission.

3. Business Presentations

a. Preparing effective Presentations Power Point Presentations
b. Power Point Presentations
c. Using Visual Aids
d. Mock Presentations

4. Employability Skills

a. Group Discussion
b. Team Building and Leadership Qualities
c. Interview Skills

References :

1. Personality Development and Soft skills (Second Edition), Barun K. Mithra. Oxford University Press: 2016
2. The Definitive Book of Body Language, Allan & Barbara. Pease International:2004
3. Working with Emotional Intelligence, Daniel Goleman. Bloomsbury:1998
4. English for Jobseekers, Lina Mukhopadhyay. Cambridge University Press:2013
5. The 7 Habits of Highly Effective People, Stephen R.Covey. St. Martin's Press:2014

Software Engineering Lab

III B.Tech – V Semester(Code: 20DSL502/CC17)

Lectures:	0 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	1.5

Pre-Requisite: None.

Course Objectives: Students will be able to

- Able to prepare problem statement and SRS (software requirements specification) document.
- Able to develop various analysis modeling diagrams.(use-case, activity, class etc.)
- Able to develop various design representations (component diagrams and deployment diagrams)
- Able to perform various testing techniques (black box and white box)

Course Outcomes: Students will be able to

CO1 Prepare SRS document.
CO2 Develop various analysis modeling representations using StarUML tool.
CO3 Develop various design representations using StarUML tool.
CO4 Perform various testing strategies on code.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO2	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO3	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO4	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3

List of Experiments

Tool Required: **StarUML**

List of Tasks

1. Write down the problem statement for a suggested system of relevance.
2. Do requirement analysis and develop Software Requirement Specification Sheet(SRS) for suggested system.
3. To perform the function oriented diagram: Data Flow Diagram (DFD) and Structured chart.
4. To perform the user‘s view analysis for the suggested system: Use case diagram.
5. To draw the structural view diagram for the system: Class diagram, object diagram.
6. To draw the behavioral view diagram : State-chart diagram, Activity diagram
7. To perform the behavioral view diagram for the suggested system : Sequence diagram,Collaboration diagram
8. To perform the implementation view diagram: Component diagram for the system.
9. To perform the environmental view diagram: Deployment diagram for the system.
10. To perform various testing using the testing tool unit testing, integration testing for a samplecode of the suggested system.

List of Applications

Choose any one project and do the above exercises for that project

1. Student Result Management System
2. Library management system
3. Inventory control system
4. Accounting system
5. Fast food billing system
6. Bank loan system
7. Blood bank system
8. Railway reservation system
9. Automatic teller machine
10. Video library management system
11. Hotel management system
12. Hostel management system
13. E-ticking
14. Share online trading
15. Hostel management system
16. Resource management system
17. Court case management system

Text Books :

1. Roger S.Pressman, "Software Engineering- A Practitioner's Approach", **McGraw Hill** , 2014, 8th. **McGraw Hill** ISBN- **978-0078022128**

References :

1. K.K. Aggarwal & Yogesh Singh, "Software Engineering", New Age International, 2008, Third Edition,. ISBN- **978-8122423600**
2. Pankaj Jalote, "An Integrated Approach to Software Engineering", Springer, 2005, Second Edition. ISBN- 978-0-387-20881-7
3. Ian Sommerville, "Software Engineering", Pearson Education, 2017, 10th Edition. ISBN-13 : 978-9332582699
4. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, "Fundamentals of Software Engineering", PHI, 2002, Second Edition. ISBN - 978-8120322424
5. RajibMall, "Fundamentals of Software Engineering", PHI, 2018, 5thEdition, PHI. ISBN- 978-9388028028

Enterprise Programming Lab

(Job Oriented Elective Lab – 1)

III B.Tech – V Semester (Code: 20DSL503/JOL1A)

Lectures:	0 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	1.5

Pre-Requisite: Object Oriented Programming(20DS303), Web Technologies(20DS402)

Course Objectives: Students will be able to

- Develop an application using servlets and JDBC.
- Design an application using JSP and JSF.
- Create an application on web services and web sockets.
- Code an enterprise application using EJBs and Persistence API

Course Outcomes: Students will be able to

CO1 Develop an application using servlets and JDBC.
CO2 Design an application using JSP and JSF.
CO3 Create an application on web services and web sockets.
CO4 Code an enterprise application using EJBs and Persistence API

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO2	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO3	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO4	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3

List of Experiments

1. Write a JDBC application to implement DDL and DML commands.
2. Write an application to demonstrate HTTP Servlets.
3. Write an application to demonstrate cookie & Sessions.
4. Write an application to integrate JSP & Servlets.
5. Write an application to demonstrate custom tags and standard tags in JSP.
6. Write an application to demonstrate JSF validators, event handlers and convertors.
7. Write an application to demonstrate web service.
8. Write a chat application using Web sockets.
9. Write an application to demonstrate Session Bean and Entity Bean (persistence).
10. Write an application to demonstrate Asynchronous and Timer services of Enterprise Bean.

Text Books :
1. Dr. Danny Coward, “Java EE 7: The Big Picture”, oracle press.
2. Arun Gupta “Java EE 7 Essentials” O’Reilly.

References :
1. Antonio Goncalves “Beginning Java EE 7” apress.

Middleware Technologies Lab

(Job Oriented Elective Lab – 1)

III B.Tech – V Semester (Code: 20DSL503/JOL1B)

Lectures:	0 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	1.5

Pre-Requisite: Object Oriented Programming(20DS303), Web Technologies(20DS402)

Course Objectives: Students will be able to

- Understand the operations of HTML & Web controls with tracing.
- Apply styles using validation controls and rich controls by applying state management.
- Do operations on the database with ADO.NET fundamentals and format the data with data controls.
- Learn the framework, working with web services by following MVC.

Course Outcomes: Students will be able to

CO1 Execute applications using HTML & Web controls with tracing.
CO2 Implement applications on rich controls and validation controls with state management.
CO3 Interpret the applications on ADO.NET fundamentals for matching data with data controls.
CO4 Solve the applications on framework and web services by following MVC.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO2	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO3	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO4	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3

List of Experiments

1. Design an ASP.NET application to demonstrate Web Form markup and redirection.
2. Design an ASP.NET application to demonstrate Web Controls and Html controls.
3. Design an ASP.Net application to demonstrate List Controls and to display a table dynamically.
4. Design an ASP.Net application to demonstrate Cross page Postback and QueryString to transfer data between Web pages.
5. Design an ASP.Net application to demonstrate the use of Cookies and using cookies how to transfer data between web pages.
6. Design an ASP.Net application to demonstrate use of session state and using session state how to transfer data between Web Pages.
7. Design an ASP.NET application to demonstrate Validating ASP.NET Web Pages using Validation Controls.
8. Design an ASP.NET application to demonstrate Rich Controls.
9. Design an ASP.NET Web Site with Styles, Themes and Master Pages.
10. Design an ASP.NET application to work with SQL Server Database using ADO.NET.
11. Design an ASP.NET application to work with SQL Server Database using Data Controls.
12. Design an ASP.NET application to work with SQL Server Database using LINQ Queries.
13. Design an application to demonstrate a Web Service Creation and Consumption.
14. Design a Simple MVC Web Pages Application.

Text Book(s):

1. "Beginning ASP.NET 4.5 in C#", Matthew MacDonald, Apress Publishing Company.
2. "Professional ASP.NET 4.5 in C# and VB", Jason N. Gaylord, Christian Wenz , Pranav Rastogi, Todd Miranda, Scott Hanselman, John Wiley & Sons, Inc., Indianapolis, Indiana
3. "Pro ASP.NET MVC 5", Adam Freeman, Apress Publishing Company.

References:

1. "Microsoft Windows Communication Foundation Step by Step", john sharp, Microsoft Press.

Data Handling & Visualization Lab

(Job Oriented Elective Lab – 1)

III B.Tech – V Semester(Code: 20DSL503/ JOL1C)

Lectures:	0 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	1.5

Pre-Requisite: None.

Course Objectives: The student will be able to

- Comprehend the prevalence of data and evolution of data visualization
- Handle data from various sources.
- Process data and missing values
- Plot various types of charts, graphs for data visualization

Course Outcomes: Students will be able to

CO1 Understand eras of data evolution and GESTALT's principles of visual perception.
CO2 Reading data from different data file formats using Python, Pandas package.
CO3 Perform filtering, reshaping, merging, sub-setting and filling null values using Pandas.
CO4 Draw scatter plot, pie charts, bar charts, bubble charts, distplots, swamplots, … using matplotlib, plotly and Seaborn.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1	3	-	3	-	-	-	-	-	-	1	3	3	3
CO2	1	1	3	-	3	-	-	-	-	-	-	1	3	3	3
CO3	1	1	3	-	3	-	-	-	-	-	-	1	3	3	3
CO4	1	1	3	-	3	-	-	-	-	-	-	1	3	3	3

List of Experiments

Tool Required: Python with Pandas, Matplotlib, Plotly and Seaborn

1. Write code to read data from text file, CSV file, Excel file and JSON file into a dataframe. Print the overview of data and slice data using different indexing/slicing methods.
2. Write code to read data with null values from a source file and process null values in various ways of filling and dropping null values.
3. a) Create multiple series objects and create a dataframe with column names and indexing from series objects. Use different parameters of DataFrame method.
   b) Write code to read data from a XML file and Microsoft Access Database.
4. Read data into a dataframe and apply Groupby, aggragation, nested groups, looping over groups operations.
5. Using Matplotlib package, draw the following.
   a) Scatter Plot b) Bar Plot c) Pie Chart d) Histogram e) Box Plot
6. Using Matplotlib package, draw the following.
   a) Treemap b) Heat Map c) Waterfall Chart d) Bubble Chart
7. Using plotly package, draw the following.
   a) Scatter Plot b) Bar Plot c) Pie Chart d) Histogram e) Box Plot

8. Using plotly package, draw the following.
   a) Word Cloud b) Treemap c) Choropleth Chart d) Area Chart e) Bubble chart f) Violin Plot
9. Using Seaborn package, draw the following.
   a) Scatter Plot b) Strip Plot c) Swarm Plot d) Count Plot e) Box Plot.
10. Using Seaborn package, draw the following.
    a) Pair Plot b) Cat Plot c) Count Plot d) Implot Plot e) DistPlot.

Case Study: Perform Exploratory Data Analysis on a dataset of your choice.

Text Books:
1. Reimagining Data Visualization Using Python by Seema Acharya, Wiley india Publication 2021.

References:

Summer Internship

III B.Tech – V Semester (Code: 20DSL504/INT01)

Lectures:	0 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	00	SEE Marks:	100	Credits:	1.5

Pre-Requisite: None.

Course Objectives: To make the students

- To enable students to apply academic concepts to practical, real-world computer science problems.
- To cultivate essential professional competencies, including teamwork, communication, critical thinking, problem-solving, and time management.
- To provide a realistic understanding of industry practices, work culture, and the day-to-day operations of a technology company.
- To expose students to ethical considerations and professional conduct in a corporate setting.

Course Outcomes: At the end of the course, students will be able to

CO1	To apply and adapt industry knowledge to solve practical problems in a professional setting.
CO2	Demonstrate improved teamwork, communication, problem-solving, and time management skills.
CO3	Build a professional network by interacting with industry professionals and peers.
CO4	Real projects to add to their portfolio, providing tangible evidence of their abilities.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	2	2	-	2	2	3	3	-	3	3	2	2
CO2	3	3	2	2	2	-	2	2	3	3	-	3	3	2	2
CO3	3	3	2	2	2	-	2	2	3	3	-	3	3	2	2
CO4	3	3	2	2	2	-	2	2	3	3	-	3	3	2	2

Guidelines and Evaluation of Internship Program

As per R20 guidelines, every student has to undergo internship twice, once between IV and V semester, the other between VI and VII Semester. The first internship is for duration of 4 weeks and the second internship is for duration of 6 weeks.

There shall be a departmental internship committee consisting of the Head of the Department and two faculty members nominated by the HOD. The committee shall identify the potential organizations which can provide internship opportunity to the students. The department shall enter into an MOU with the concerned organization and the details will be shared with the students.

The students shall be informed to apply for undergoing internship in the specified proforma. The details and consent of the organization in which he/she is seeking for internship are to be furnished. Further, the student along with the parent must submit an undertaking form. The committee shall scrutinize the applications and approve the same. If a student fails to acquire internship, he/she may be permitted to undergo equivalent work (mini project, research project, fabrication work, field work, research paper, etc.,) in the department under the guidance of a faculty member.

After the completion of the internship, the student must submit the report and attend a departmental internal assessment for award of grade and credits.

Weightage for Evaluation: The various stages of evaluation and weightage at each stage are given below.

Stage	Marks	Remarks
Internship Certificate	20M	Company Supervisor will assess the interns in the internship company premises. Company supervisor assesses the intern and provide certificate
Report Submission	30M	After the completion of the internship, the student must submit the report along with certificate.
Final Assessment – in the college premises	50M	The HOD of the concern department acts as convener of the committee and two faulty members are members to assess the intern's performance

Essence of Indian Traditional Knowledge

III B. Tech. – V Semester (Code: 20DS506/MC03)

Lectures:	2 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	00	Credits:	0.0

Pre-Requisite: None

Course Objectives: Students will be able to

- Generalize the effect of precolonial and colonial period on Indian Traditional Knowledge System, traditional Medicine,
- Discover the knowledge of ITK in Production, Construction, Physics, Chemistry, Architecture and Vastu.
- Discriminate the contribution of India in Mathematics, Astronomy & Astrology.
- Propose the importance of Yoga in holistic living.

Course Outcomes: Students will be able to

CO1 Acknowledge the significance of ITK, the results of colonial rule, and conventional medicine.
CO2 Know how well ITKS performs in the fields of architecture, physics, and chemistry.
CO3 Discover about India's contributions to mathematics and astronomy.
CO4 Know the benefits of Yoga, yogasanas, pranayama in leading a Happy and Healthy life

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	-	-	-	-	-	3	3	1	-	-	-	1	-	-	-
CO2	-	-	-	-	-	3	3	1	-	-	-	1	-	-	-
CO3	-	-	-	-	-	3	3	1	-	-	-	1	-	-	-
CO4	-	-	-	-	-	3	3	1	-	-	-	1	-	-	-

UNIT-1 8 Hours

Historical Background: TKS during the Pre-colonial and Colonial Period
Indian Traditional Knowledge System
Traditional Medicine: Ayurveda, Simple Definition, Origin, The Great Three Classics of Ayurveda, The Branches of Ayurveda, Basic Concepts of Ayurveda, Purusha/Prakruti, Manifestation of Creation, Mental Constitution, Vata, Pitta and Kapha: The Three Doshas

UNIT-2 8 Hours

Traditional Production and Construction Technology: Social Conditions and Technological Progress, The Impetus for Metallurgy, Social Needs and Technological Applications, State Support of Technology, India and the Industrial Revolution.
History of Physics and Chemistry: Philosophy and Physical Science, Optics and Sound, The Laws of Motion, The Five Basic Physical Elements, Indian Ideas about Atomic Physics.
Traditional Art and Architecture and Vastu Shashtra: The Principles of Vastu are simple

UNIT-3 8 Hours

Origin of Mathematics: The Decimal System in Harappa, Panini and Formal Scientific Notation, The Indian Numeral System, Emergence of Calculus, The Spread of Indian Mathematics, The Concept of Zero.
Astronomy and Astrology

TKS and the Indian Union: Protection and the Legislative Frameworks in India, Comment, Sui Generis System, Trade Secrets and Know-how, Geographical Indications Bill, Protection of Plan varieties and Farmers Rights Bill, Rights of Communities, Monitoring Information on Patent Applications World-wide.

UNIT-4 8 Hours

Common Yoga Protocol: Introduction, What is Yoga? Brief History and Development of Yoga, The fundamentals of Yoga,

General Guidelines for Yoga Practice: Before the practice, During the Practice, After the Practice, Food for Thought, How Yoga can Help.

Invocation, 2. Sadilaja/Cālana Kriyās /Loosening Practices,

Yogāsanas:

Standing Postures: Tāḍāsana (Palm Tree Posture), **Vṛkṣāsana** (The Tree Posture), **Pāda-Hastāsana** (The Hands to Feet Posture), **Ardha Cakrāsana** (The Half Wheel Posture), **Trikonāsana** (The Triangle Posture)

Sitting Postures: Bhadrāsana (The Firm/Auspicious Posture), **Vajrāsana** (Thunderbolt Posture), **Uṣṭrāsana** (Camel Posture), **Śaśakāsana** (The Hare Posture), **Vakrāsana** (The Spinal Twist Posture),

Kapālabhāti 5. Prānāyāma: naḍīśodhana or anuloma viloma prānāyāma (Alternate Nostril Breathing), **Śītalī Prāṇāyāma, Bhrāmarī Prāṇāyāma** (Bhrāmarī Recaka) **6. Dhyāna 7. *Sankalpa* 8. Śantih pātha**

Text Books :
1. Traditional Knowledge System in India, Amit Jha, 2009
2. Common YOGA Protocol, Ministry of Ayush

References :
1. Traditional Knowledge System & Technology in India, Basanta Kumar Mohanta, Vipin Kumar Singh, 2012

Compiler Design

III B. Tech. – VI Semester (Code: 20DS601/CC18)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Automata Theory & Formal Languages (20DS501)

Course Objectives: Students will be able to

- To comprehend the principles involved in the design and construction of compilers, the algorithms involved in the design and construction of compilers, Understand the design of lexical analyzer
- To practice Various Bottom up parsing techniques.
- To apply Various Intermediate languages. To understand Code generation algorithm
- Various storage allocation strategies, Various Symbol table data structures.

Course Outcomes: Students will be able to

CO1 Comprehend the ideas of compiler design and construction, as well as the algorithms underlying these processes, Recognize the lexical analyzer's layout.
CO2 Practice different Bottom-up parsing methods.
CO3 Implement a number of intermediate languages. in order to comprehend the code generating algorithm.
CO4 Illustrate the Various storage allocation strategies and Symbol table data structures.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO4	2	2	2	-	-	-	-	-	-	-	-	-	3	2	-

UNIT-1 12 Hours

Introduction: Language Processors, The Structure of a Compiler.
Lexical Analysis: The Role of the Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, The Lexical-Analyzer Generator Lex.
Syntax Analysis: Introduction, Writing a Grammar: elimination of left recursion, left factoring, **Top-Down Parsing**: Recursive-Descent Parsing, FIRST and FOLLOW, LL(1) Grammars, Non-recursive Predictive Parsing.

UNIT-2 12 Hours

Bottom-Up Parsing: Introduction to LR Parsing: Simple LR, More Powerful LR Parsers: Canonical LR(1) Items, Constructing LR(1) Sets of Items, Canonical LR(1) Parsing Tables, Constructing LALR Parsing table. The Parser Generator YACC.
Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Construction of syntax trees.

UNIT-3 12 Hours

Intermediate-Code Generation: Variants of Syntax Trees, Three-Address codes, Translation of expressions: Operations within expressions, Incremental translation, control flow: Boolean expressions: Short circuited code Flow of control statements, Control flow translation of Boolean expressions, Back-patching for Boolean Expressions.

Code Generation: Issues in the Design of a Code Generator, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, A Simple Code Generator.

UNIT-4 12 Hours

Run-Time Environments: Storage Organization, Static allocation strategy, Stack Allocation of Space: Activation trees, Activation records, calling sequence, variable length data on the stack.
Symbol Tables: Symbol table entries, Data structures to symbol tables, representing scope information.

Text Books :
1. Alfred V.Aho, RaviSethi, JD Ullman, "Compilers Principles, Techniques and Tools", Pearson Education, Second Edition, 2013.

References :
1. Alfred V.Aho, Jeffrey D. Ullman, "Principles of Compiler Design", Narosa publishing.
2. "Lex&YACC", John R. Levine, Tony Mason, Doug Brown, O'reilly.
3. "Modern Compiler Implementation in C", Andrew N. Appel, Cambridge University Press.

Machine Learning

III B. Tech. – VI Semester (Code: 20DS602/CC19)

Lectures:	2 Hours/week	Tutorial:	1 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Basic Calculus and Probability

Course Objectives: Students will be able to

- Learn a Regression Model.
- Comprehend a Supervised Learning Model.
- Apply Ensemble methods for improving the performance of a Learning Model.
- Apply an Unsupervised Learning Model.

Course Outcomes: Students will be able to

CO1 Understand a very broad collection of machine learning algorithms,problems and apply the correct regression model for the given problem and implement it.

CO2 Analyze the supervised discriminative and generate models for the given problem and implement it.

CO3 Identify the supervised strong learning model for the given problem and implement it.

CO4 Learn the basics of the learning problem with hypothesis,version spaces and choose the correct clustering algorithm for the given problem and implement it.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	3	-	-	-	-	-	-	2	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	-	2	3	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-	2	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	-	2	3	3	3

UNIT-1 12 Hours

Machine learning basics: What is machine learning? Key terminology, Types of Machine Learning Systems, how to choose the right algorithm, Steps in developing a machine learning application, Main Challenges of Machine Learning Essential Python Libraries: Scikit-learn, NumPy, matplotlib, Pandas. A First Application: Classifying iris species using Sci-kit learn.

Linear Regression: Simple linear regression. Optimization of model parameters using Batch gradient decent algorithm, Mini batch gradient decent algorithm and Stochastic gradient descent algorithm, Multiple linear regression, locally weighted linear regression, Polynomial Regression. Regularized Linear Models- Ridge Regression and Lasso Regression

Regularization: Bios Variance tradeoff, L1 and L2 regularization.

UNIT-2 12 Hours

Generative Classifiers: Classifying with Bayesian decision theory, Bayes' rule, Naïve Bayes classifier.

Discriminative Classifiers: Logistic Regression, Decision Trees: Training and Visualizing a Decision Tree, Making Predictions, Estimating Class Probabilities, The CART Training Algorithm, Attribute selection measures- Gini impurity; Entropy, Regularization Hyperparameters, Regression Trees, Linear Support vector machines.

UNIT-3 12 Hours

Evaluation of a Classifier: Measuring Accuracy Using Cross-Validation, Confusion Matrix, Precision and Recall, Precision/Recall Trade-off, The ROC Curve.

Ensemble Learning: Voting Classifiers, Bagging and Pasting, Random Forests, Boosting-AdaBoost and Gradient Boosting.

UNIT-4 12 Hours

Computational Learning Theory: Introduction, probably learning an approximately correct hypothesis, sample complexity for finite hypothesis spaces.

Instance-based Learning: Introduction, K-nearest neighbors.

Unsupervised Learning: K-means clustering algorithm, Hierarchical clustering algorithm, Gaussian mixture model.

Text Books :

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, Second Edition, Aurelien Geron, O'Reilly publishers, ISBN: 781492032649.
2. Andreas C. Muller and Sarah Guido. Introduction to Machine Learning with Python. Oreilly, 1 edition, 2016. ISBN 9781449369415.

References :

1. Peter Harrington Machine Learning in Action. Manning, I edition, 2012.
2. Andrew Ng. Machine Learning Lecture Notes. Stanford University. URL https://seeedu/course/CS229.
3. Sebastain Raschka and Vahid Mirjalili. Python Machine Learning. Packt Publishing, 2 edition, 2017. ISBN 97893252136278.
4. Tom M. Mitchell. Machine Learning, 1 edition, 1997. ISBN 0070428077. URL http://www.cs.cmu.edu/~ tom/mlbook.html.

Cryptography & Network Security

III B. Tech. – VI Semester (Code: 20DS603/CC20)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Computer Networks (20DS502)

Course Objectives: Students will be able to

- Know about security services, attacks and various encryption techniques.
- Understand the concept of public key cryptography and study about message authentication and hash functions.
- Understand the digital signature, key management and email security mechanisms
- Impart knowledge on Transport layer & Network layer security

Course Outcomes: Students will be able to

CO1	Identify common network security vulnerabilities/attack and understand various symmetric encryption techniques.
CO2	Analyze and apply the concepts of various public key encryption and cryptographic hash functions.
CO3	Evaluate the authentication, key management and describe various application layer mechanisms.
CO4	Illustrate the various security mechanisms of transport layer and network layer.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	2	2
CO2	2	3	3	-	-	-	-	-	-	-	-	-	3	2	2
CO3	2	2	-	-	-	-	-	-	-	-	-	-	-	2	2
CO4		2	3	-	-	-	-	-	-	-	-	-	-	2	2

UNIT-1 12 Hours

Introduction: Security Goals, Attacks, Service and Mechanism, Techniques

Traditional symmetric key ciphers: Introduction, Substitution Ciphers, Transposition Ciphers, Stream and Block Ciphers

Data Encryption Standard (DES): Introduction, DES Structure, DES Analysis, Multiple DES, Security of DES

Encipherment using Modern Symmetric Key Ciphers: Use of Modern Block Ciphers

UNIT-2 12 Hours

Advanced Encryption Standard: Introduction, Transformations, Key Expansion, Ciphers.

Asymmetric Key Cryptography: Introduction, RSA Cryptosystem, Robin Cryptosystem, Elgamal Cryptosystem.

Message Integrity and Message Authentication: Message Integrity, Message Authentication.

Cryptographic Hash Functions: Introduction, SHA-512.

UNIT-3 12 Hours

Digital Signatures: Comparison, Process, Services, Attacks on Digital Signature, Digital Signature Standard.

Key Management: symmetric key distribution, Kerberos, Symmetric Key Agreement, Public Key Distribution.
Security at the Application Layer: E-Mail, PGP.

UNIT-4 12 Hours

Security at the Transport Layer: SSL Architecture, Four Protocols, SSL Message Format, Transport Layer Security.
Security at the Network Layer: Two Modes, Two Security Protocols, Security Association, Security Policy, Internet Key Exchange, ISAKMP.

Text Books : 1. Cryptography and Network Security - Behrouz A. Forouzan

References :
1. William Stallings "Cryptography and Network Security" 4th Edition, (Pearson Education/PHI).
2. Kaufman, Perlman, Speciner, "NETWORK SECURITY", 2nd Edition, (PHI / Eastern Economy Edition)
3. Trappe & Washington, "Introduction to Cryptography with Coding Theory", 2/e, Pearson.

Distributed Systems

(Professional Elective – II)

III B. Tech. – VI Semester (Code:20DS604/PE2A)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Operating Systems(20DS304), Computer Networks(20DS502)

Course Objectives: Students will be able to

- Understand and comprehend the architecture of distributed systems.
- Understand and comprehend process in distributed systems.
- Understand and apply naming and coordination of systems.
- Understand consistency and fault tolerance in distributed systems.

Course Outcomes: Students will be able to

CO1 Recognize the definition of a distributed system, the rationale behind designing a system in this way, and the desired characteristics of such systems.
CO2 Describe the process and communication of distributed system.
CO3 Describe the synchronization of distributed system.
CO4 Recognize the consistency and replication of distributed system.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	-	-	-	-	-	-	-	2	1	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	1	1	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-	1	1	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	2	1	-

UNIT-I 12 Hours

Introduction: What is a distributed system? Design goals, Types of distributed systems. **Architectures:** Architectural styles, Middleware organization, System architecture, Example architectures.

UNIT-II 12 Hours

Processes: Threads, Virtualization, Clients, Servers, Code migration.
Communication: Types of Communication, Remote procedure call, Message-oriented communication, Multicast communication.

UNIT-III 12 Hours

Naming: Names, identifiers, and addresses, Flat naming, Structured naming, Attribute- based naming.
Coordination: Clock synchronization, Logical clocks, Mutual exclusion, Election algorithms, Location systems.

UNIT-IV 12 Hours

Consistency and replication: Introduction, Data-centric consistency models, Client-centric consistency models, Replica management, Consistency protocols.
Fault tolerance: Introduction to fault tolerance, Process resilience, Reliable client-server communication, Reliable group communication, Distributed commit, Recovery.

Text Book(s) :

1. Andrew S.Tanenbaum, Maarten Van Steen, “Distributed Systems”, Third Edition (2017), Pearson Education/PHI.

References :

1. Coulouris, Dollimore, Kindberg, “Distributed Systems-Conceptsand Design”, 3rd edition, Pearson Education.
2. Mukesh, Singhal & Niranjan G.Shivarathri, “Advanced Conceptsin Operating Systems”, TMH.
3. Sinha, “Distributed Operating System – Concepts and Design”, PHI.

Blockchain Technologies

(Professional Elective – II)

III B. Tech. – VI Semester (Code:20DS604/PE2B)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Prerequisites: Cryptography & Network Security (20DS603)

Course Objectives: Students will be able to

- Understand the introduction concepts of Blockchain and the importance of decentralization in Blockchain.
- Acquire the knowledge of several cryptographic algorithms and bitcoin transactions.
- Understand the concepts of Smart Contracts and Ethereum blockchain
- Understand Hyperledger, alternative Blockchains.

Course Outcomes: Students will be able to

CO1 Understand the blockchain technology in decentralized paradigm.

CO2 Apply cryptographic algorithms and understand the concepts of bitcoin.

CO3 Understand the concepts of smart contracts.

CO4 Explain the importance and applications of Hyperledger. Understand the other blockchains.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	-	-	3	-	-	-	-	-	2	-	3	3
CO2	3	3	3	-	-	3	-	-	-	-	-	2	-	3	3
CO3	3	3	3	-	-	3	-	-	-	-	-	2	-	3	3
CO4	3	3	3	-	-	3	-	-	-	-	-	2	-	3	3

UNIT-I 12 Hours

Block Chain 101 - Distributed Systems, The History of blockchain, Introduction to blockchain, Types of block chain, CAP theorem and blockchain, Benefits and limitations of blockchain,

Decentralization - Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Blockchain and full eco system decentralization, Smart contract, Decentralized Organizations, decentralized autonomous organizations, Decentralized autonomous corporations, Decentralized autonomous societies, Decentralized applications, Platforms for Decentralization.

UNIT-II 12 Hours

Cryptography and Technical Foundations - Introduction, Cryptographic primitives, Asymmetric Cryptography, Public and Private-keys – RSA, Discrete logarithm problem, Cryptographic primitives, Hash functions-Merkle trees, Patricia trees.

Bitcoin - Bitcoin, Transactions, Blockchain.

UNIT-III 12 Hours

Alternative Coins – Bitcoin limitations - Privacy and anonymity, Extended protocols on top of bitcoin, Development of altcoins.

Smart Contracts - History, Definition, Ricardian Contracts.

UNIT-IV 12 Hours

Hyperledger - Projects, Hyperledger as a Protocol, Fabric, Hyperledger Fabric, Sawtooth lake-PoET, Transaction families, Consensus in Sawtooth.
Alternative Blockchain - Blockchains.

Text Book(s) :

1. Mastering Blockchain, Packt Publishing by Imran Bashir

References :

1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos Blockchain, IBM Limited Edition, Published by John Wiley &Sons, Inc. www.wiley.com
2. Blockchain by Melanie Swa, O'Reilly
3. Hyperledger Fabric -https://www.hyperledger.org/projects/fabric Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html

Reinforcement Learning

(Professional Elective – II)

III B. Tech. – VI Semester (Code:20CS604/PE2C)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: None.

Course Objectives: Students will be able to

- To understand the fundamentals of Reinforcement Learning (RL).
- To learn the RL framework and Markov Decision Processes (MDPs).
- To analyses RL problems using Dynamic Programming and Monte Carlo methods.
- To study Temporal Difference methods and advanced Deep RL algorithms.

Course Outcomes: Students will be able to

CO1 Able to understand the basics of Reinforcement Learning (RL).

CO2 Able to model problems using RL Framework and Markov Decision Processes (MDPs).

CO3 Able to apply Dynamic Programming and Monte Carlo techniques.

CO4 Able to implement TD(0), TD(λ), and Deep Reinforcement Learning algorithms.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	-	3	2	-	-	-	-	-	-	-	-	2	1
CO2	2	2	-	2	2	-	-	-	-	-	-	-	2	2	2
CO3	1	3	2	-	-	-	2	-	-	-	-	-	2	-	2
CO4	1	2	1	-	-	-	2	-	-	-	-	-	1	-	2

UNIT-I 12 Hours

Reinforcement Learning: Introduction, Examples, Elements of reinforcement Learning **Tabular Solution Methods:** Multi-armed Bandits - n-armed Bandit Problem, Action Value Methods, Incremental Implementation, Optimistic Initial Values, Upper-Confidence-Bound Action Selection, Gradient Bandit Algorithms.

UNIT-II 12 Hours

Finite Markov Decision Processes: Markov Decision Processes (MDPs) and the agent-environment interaction, Value functions and Bellman equations. **Dynamic Programming:** Policy evaluation, policy improvement, and policy iteration, Value iteration and the Bellman optimality equation, Model-based vs. model-free approaches.

UNIT-III 12 Hours

Monte Carlo Methods: Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Monte Carlo Control without Exploring Starts, Incremental Implementation.

Temporal Difference Learning: TD Prediction, Advantages of TD Prediction Methods, Optimality of TD(0), Sarsa: On-Policy TD Control, Q-Learning: Q-Policy TD Control.

UNIT-IV 12 Hours

Eligibility Traces: n-Step TD Prediction, The Forward View of TD(λ), The Backward View of TD(λ), Equivalences of Forward and Backward Views.

Deep Reinforcement Learning: Deep Q-Networks (DQN) and experience replay, Double DQN and dueling architectures.

TextBook(s):

1. Reinforcement Learning - An Introduction - 2022 Second Edition, Richard S Sutton and Andrew G. Barto
2. Reinforcement Learning - A Complete Guide - 2021 Edition, Emereo Publishing, Practical Tools for Self-Assessment.

References:

1. Bandit algorithms, First Edition, Lattimore, T. and C. Szepesvári. Cambridge University Press. 2020.
2. Reinforcement Learning Algorithms: Analysis and Applications, Boris Belousov, Hany Abdulsamad, Pascal Klink, Simone Parisi, and Jan Peters, First Edition, Springer 2021.
3. Alexander Zai and Brandon Brown Deep Reinforcement Learning in Action, First Edition, Manning Publications 2020.

Mobile Application Development & Security

(Job Oriented Elective – II)

III B. Tech. –VI Semester (Code: 20DS605/JO2A)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Object Oriented Programming (20DS303)

Course Objectives:

- Understand the Android Application Architecture and Working.
- Understand how to develop android applications and internal working of applications
- Understand different types of layouts, animations, activities, Intents in Android apps.
- Able to understand common mobile application security vulnerabilities.

Course Outcomes: Students will be able to:

CO1 Able to understand and develop basic android applications.
CO2 Able to understand the internal working of the Android Applications
CO3 Able to understand different types of layouts, animations, activities, Intents in Android apps.
CO4 Able to understand common mobile application security vulnerabilities

Course Outcome, Program Objectives & Program Specific Objectives Mapping

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	2	-	1	-	-	-	-	-	-	-	-	2	-	-
CO2	1	2	3	1	1	-	-	-	-	1	-	-	1	2	1
CO3	-	-	3		2	-	1	-	-	1	-	1	2	2	1
CO4	1	1	2		2	-	1	-	-	1	-	1	2	2	1

UNIT-1 12 Hours

Hello, Android:- ANDROID: An Open Platform for Mobile Development, Android SDK Features, Introducing the Development Framework

Getting Started:- What You Need to Begin, Creating Your First Android Application, Types of Android Applications

UNIT-2 12 Hours

Creating Applications and Activities:- What Makes an Android Application?, Introducing the Application Manifest File, Externalizing Resources, The Android Application Lifecycle, A Closer Look at Android Activities, Creating Activities, The Activity Lifecycle, Activity States.

Building User Interfaces: - Fundamental Android UI Design, Android User Interface Fundamentals, Introducing Layouts, Introducing Fragments.

UNIT-3 12 Hours

Intents and Broadcast Receivers:- Introducing Intents, Creating Intent Filters and Broadcast Receivers

Saving State and Preferences: - Creating and Saving Shared Preferences , Retrieving Shared Preferences Persisting the Application Instance State.

UNIT-4 12 Hours

Security:- Top Issues Facing Mobile Devices, Types of Security threats in mobile application, Tips for Secure Mobile Application Development, Securing Mobile services, Security Testing for Mobile Apps

Text Books :

1. Professional Android 4 Application Development‖, Reto Meier, John Wiley & Sons, Inc.

References :

1. Android Programming The Big Nerd Ranch Guide‖, Brian Hardy & Bill Phillips, Big Nerd Ranch, Inc.
2. Head First: Android Development‖, Dawn Griffiths & David Griffiths, O‘Reilly Publications.

Industrial IOT

(Job Oriented Elective – II)

III B. Tech. –VI Semester (Code: 20DS605/JO2B)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Basic Knowledge of Hardware and Programming

Course Objectives: Students will be able to

- Make the students to know the IoT challenges and architectures.
- Provide an understanding of the technologies and the standards relating to the Internet of Things.
- Understanding the concept of M2M (machine to machine) with necessary protocols.
- Design and develop skills on IoT applications.

Course Outcomes: Students will be able to

CO1 Understand the basics of physical and logical design of the IoT.
CO2 Acquire skills required for development of IoT applications.
CO3 Design of the IoT applications based on M2M and design methodology
CO4 Create the IoT applications for real time problems

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	-	3	-	3	-	-	-	-	-	-	2	2	-	-
CO2	2	-	3	-	3	-	-	-	-	-	-	2	2	2	
CO3	2	-	3	-	3	-	-	-	-	-	-	2	2	-	-
CO4	2	-	3	-	3	-	-	-	-	-	-	2	2	2	-

UNIT-1 12 Hours

Introduction to IoT: The flavour of the IoT, the technology of the IoT, characteristics of IoT, physical design of IoT, logical design of IoT, IoT enabling technologies, IoT levels & deployment templates

UNIT-2 12 Hours

Elements of IoT: Hardware Components-Computing (Arduino, Raspberry Pi), Sensors, Actuators, I/O interfaces, Communication Protocols (ZigBee, Bluetooth, 6LoPAN, and MQTT), Software Components-Programming API‟s (using Python/Arduino).

UNIT-3 12 Hours

M2M and IoT Design Methodology:

M2M, Differences and Similarities between M2M and IoT, IoT Design Methodology.

UNIT-4 12 Hours

Cloud for IoT and Case Studies: Introduction, IoT with Cloud – Challenges, Selection of Cloud Service Provider for IoT Applications, Introduction to Fog Computing, Cloud Computing: Security Aspects,

Case Studies: Smart Lighting, Home Intrusion Detection, Smart Parking, Weather Monitoring System, Smart Irrigation, and Adafruit Cloud

Text Books:

1. Internet of Things: A Hands-on-Approach‖, Arsh deep Bahga, Vijay Madisetti, VPT, 1st Edition, 2014.
2. Internet of Things, Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, John Wiley & Sons. 1st edition, 2019.
3. Designing the Internet of Things, Adrian McEwen, Hakim Cassimally, John Wiley and Sons, 1st Edition, 2014.
4. Internet of Things: Architecture and Design, Raj Kamal, McGraw Hill Education; 1st edition, 2017.

References :

1. Jeeva Jose, "Internet of Things", Khanna Publishing, 1st edition, 2018.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: key applications and Protocols", Wiley, 1st edition, 2015.

Business Intelligence

(Job Oriented Elective – II)

III B. Tech. –VI Semester (Code: 20DS605/JO2C)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: None.

Course Objectives: Students will be able to

- Understand the evolution and fundamentals of Business Intelligence (BI) and modern AI-driven insight systems.
- Collect, import, and prepare data from diverse sources.
- Build BI data models, perform cleaning, transformation, and analytical modeling.
- Use Power BI to create dashboards and apply Generative AI for insight automation.

Course Outcomes: Students will be able to

CO1	Understand BI fundamentals, BI lifecycle, and Power BI ecosystem.
CO2	Import and prepare data using Power Query with cleaning and transformation techniques.
CO3	Build BI models, create DAX measures, KPIs, and perform analytical insights.
CO4	Create interactive dashboards and apply AI-driven insight automation features.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1	3	-	3	-	-	-	-	-	-	1	3	3	3
CO2	1	1	3	-	3	-	-	-	-	-	-	1	3	3	3
CO3	1	1	3	-	3	-	-	-	-	-	-	1	3	3	3
CO4	1	1	3	-	3	-	-	-	-	-	-	1	3	3	3

UNIT-1 12 Hours

Introduction to Business Intelligence - What is Business Intelligence?, Evolution of BI and the need for data-driven decisions, BI vs Data Analytics vs Data Science, BI lifecycle: Data → Transform → Model → Visualize → Insights → Automation, Types of BI: Descriptive, Diagnostic, Predictive, Prescriptive, Components of BI: Data sources, ETL, modelling, visualization, automation.

Power BI Overview - Power BI Desktop, Service, Data Gateway, Key BI workflows using Power BI, Introduction to Insight Automation

Digital Data Concepts - Structured, semi-structured, unstructured data, OLTP vs OLAP

UNIT-2 12 Hours

Data Import - Excel, CSV, Text, SQL Databases (basic connection), JSON, XML, Web sources & APIs.

Power Query Editor - Data profiling, Handling missing values, Removing duplicates, Text, number, and date transformations, Column operations: split, merge, extract, and Replace errors, clean & trim, Aggregation & summarization, Merge Queries, Append Queries, Pivot and Unpivot.

AI-Assisted Data Preparation - Natural-language transformations, AI-driven column suggestions

UNIT-3 12 Hours

Data Modeling & Analytical Measures - Star schema concepts: Fact & Dimension, Managing relationships: cardinality, cross-filter direction, Calculated Columns vs Measures.

DAX Fundamentals - Basic functions: SUM, AVERAGE, COUNT, Time intelligence functions, KPIs and indicators.

Analytical Insights - Trend analysis, Outlier detection, and Comparison analysis.

AI-Assisted Modeling - Auto-insights, Explain-your-data

UNIT-4 12 Hours

Data Visualization, Dashboards & Automation- Visualization Principles: Choosing the right chart, Storytelling with data.

Power BI Visuals - Bar, Line, Pie, Donut, Waterfall, Funnel, Maps, KPI, Card, Gauge, Matrix, Slicers, Drill-down, Drill-through, Bookmarks.

Power BI Service - Publishing reports, Workspaces, Scheduled refresh, Row-Level Security (RLS).

Insight Automation - Smart Narratives, Q&A Visual, Automated summaries, Natural-language insights, AI-driven performance checks.

Text Books:

1. **Business Intelligence with Microsoft Power BI** – Packt Publishing / BPB Publications
2. **Business Intelligence Guidebook: From Data Integration to Analytics** – Rick Sherman

References :

1. ***Pro DAX with Power BI*** – Philip Seamark
2. ***The Definitive Guide to DAX*** – Marco Russo & Alberto Ferrari
3. ***Storytelling with Data*** – Cole Nussbaumer Knaflic
4. ***Power Query for Power BI and Excel*** – Chris Webb

Full Stack Development

(Skill Advanced Course – I)

III B. Tech. –VI Semester (Code: 20DSL601/SOC4)

Lectures:	2 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3.5

Pre-Requisite: Web Technologies (20DS402)

Course Objectives: Students will be able to

- Develop a WEB-API using Node.JS.
- Work with NOSQL databases like MongoDB
- Develop a front-end in Angular that consumes web-services
- Develop a responsive front-end in Angular

Course Outcomes: Students will be able to

CO1 Work with Timer Events, Listeners and Callbacks.

CO2 Access the File System from Node.js.

CO3 Use Express middleware and implement routes and templating for web application development.

CO4 Understand Cookies, Sessions and Authentication.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	3	-	3	-	-	-	-	-	-	2	3	3	3
CO2	3	2	3	-	3	-	-	-	-	-	-	2	3	3	3
CO3	3	2	3	-	3	-	-	-	-	-	-	2	3	3	3
CO4	3	2	3	-	3	-	-	-	-	-	-	2	3	3	3

UNIT-1 8 Hours

Node.js, Using Events, Timers, and Callbacks in Node.js, buffers and File system, Express with Node.js, Routes, Request and Response objects, Template engine.

UNIT-2 8 Hours

Understanding NoSQL and MongoDB, MongoDB CRUD operations Accessing MongoDB from Node.js.

UNIT-3 8 Hours

Typescript- types, interfaces, classes, modules, functions, Angular- Components, Expressions.

UNIT-4 8 Hours

Angular data binding, Built-in directives, Browser events, , Observables, Angular services.

Lab Exercises

1. Write programs
   a. to implement timers.
   b. to demonstrate different ways of performing read/write operations in local file system.
2. Code a basic Node.JS user registration application.
3. Create a CRUD application using data from local file system.

4. Create a CRUD web application using data from MongoDB server.
5. Refactor the above program to separate
   a. Model operations
   b. Controller operations
6. Code Angular applications to demonstrate
   a. Data binding.
   b. Directives
   c. Data sharing between parent/child components.
7. Create an Angular CRUD application that interacts with a REST API.

Text Books :

1. Node.js, MongoDB and Angular Web Development (Second Edition), Brad Dayley, Brendan Dayley Caleb Dayley, by Pearson Education, Inc.

References :

1. Getting MEAN with Mongo, Express, Angular, and Node, Manning Publications, ISBN-10 : 1617294756,
2. Beginning Node.js, Express & MongoDB Development, ISBN-10 : 9811480281,
3. Beginning Node.js, Basarat Syed, APress, ISBN-10: 9781484201886

Machine Learning Lab

III B. Tech. –VI Semester (Code: 20DSL602/CC21)

Lectures:	0 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	1.5

Pre-Requisite: Basic Calculus and Probability

Course Objectives: Students will be able to

- Learn a Regression Model
- Comprehend a Supervised Learning Model
- Apply Ensemble methods for improving the performance of a Learning Model
- Apply an Unsupervised Learning Model

Course Outcomes: Students will be able to

CO1 Apply the correct regressions models for the given problems and implement it.

CO2 Analyze the suitable supervised learning model for the given problem and implement it.

CO3 Identify the suitable probabilistic learning model for the given problem and implement it.

CO4 Choose the correct clustering algorithm for the given problem and implement it.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	3	-	-	2	-	2	-	3	3	3	3
CO2	3	3	3	3	3	-	-	2	-	2	-	3	3	3	3
CO3	3	3	3	3	3	-	-	2	-	2	-	3	3	3	3
CO4	3	3	3	3	3	-	-	2	-	2	-	3	3	3	3

List of Experiments

1. Write sample programs using
   a) NumPy b) Pandas
2. Write sample programs using
   a) Matplotlib b) Scikit Learn
3. Write a program to implement the linear regression using
   a) Stochastic gradient descent approach of training for a sample training data set.
   b) Batch gradient descent approach of training for a sample training data set
4. Write a program to implement the naïve Bayesian classifier for a sample training data set. Compute the performance of the classifier.
5. Write a program to implement the Logistic regression for a sample training data set and test the same using appropriate data sets.
6. Write a program to demonstrate the working of the decision tree based on ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample. Compute the performance of the classifier, considering few test data sets.
7. Write a program to implement the Random Forest classifier for a sample training data set stored as a .CSV file. Compare the performance of the classifier with any weak classifier, considering few test data sets.

8. Write a program to implement the AdaBoost classifier for a sample training data set. Compare the performance of the classifier with Random Forest classifier, considering few test data sets.
9. Apply k-Means algorithm to cluster a dataset.
10. Apply Hierarchical clustering algorithm to cluster a dataset.

Text Books:

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, Second Edition, Aurelien Geron, O'Reilly publishers, ISBN: 781492032649.
2. Andreas C. Muller and Sarah Guido. Introduction to Machine Learning with Python. Oreilly, 1 edition, 2016. ISBN 9781449369415.

References :

1. Peter Harrington Machine Learning in Action. Manning, I edition, 2012.
2. Andrew Ng. Machine Learning Lecture Notes. Stanford University. URL https://seeedu/course/CS229.
3. Sebastain Raschka and Vahid Mirjalili. Python Machine Learning. Packt Publishing, 2 edition, 2017. ISBN 97893252136278.
4. Tom M. Mitchell. Machine Learning, 1 edition, 1997. ISBN 0070428077. URL http://www.cs.cmu.edu/~ tom/mlbook.html.

Mobile Application Development & Security Lab

(Job Oriented Elective Lab – II)

III B.Tech – VI Semester (Code: 20DSL603/JOL2A)

Lectures:	0 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	1.5

Pre-Requisite: : Object Oriented Programing(20DS303)

Course Objectives:

- Understand the Android Application Architecture and Working.
- Understand how to develop android applications and internal working of applications
- Understand different types of layouts, animations, activities, Intents in Android apps.
- Understand to develop applications with SQLite database support to read, write, update and delete data.

Course Outcomes: Students will be able to:

CO1 Able to understand and develop basic android applications.

CO2 Able to understand the internal working of the Android Applications

CO3 Able to understand different types of layouts, animations, activities, Intents in Android apps.

CO4 Able to understand and develop the applications with SQLite database to read, write, update and delete data.

Course Outcome, Program Objectives & Program Specific Objectives Mapping

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO2	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO3	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO4	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3

List of Experiments

1. Design an Android application to display hello world?
2. Design an Android application to create interactive user interface?
3. Design an Android application to create and start activity?
4. Design an Android application to demonstrate different types of layouts?
5. Design an Android application to demonstrate animation?
6. Develop standard calculator application to perform basic calculator operations like addition, subtraction, multiplication and division?
7. Design an Android application to demonstrate fragments?
8. Design an Android application to demonstrate fragment lifecycle?
9. Design an Android application to demonstrate implicit Intent?
10. Design an Android application to demonstrate explicit intent?
11. Design an Android application to demonstrate shared preferences?
12. Design an Android application to demonstrate SQLite database?

Text Books :

1. Professional Android 4 Application Development‖, Reto Meier, John Wiley & Sons, Inc.

References :

1. Android Programming The Big Nerd Ranch Guide‖, Brian Hardy & Bill Phillips, Big Nerd Ranch, Inc.
2. Head First: Android Development‖, Dawn Griffiths & David Griffiths, O‘Reilly Publications.

Industrial IOT Lab

(Job Oriented Elective Lab – II)

III B.Tech – VI Semester (Code: 20DSL603/JOL2B)

Lectures:	0 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	1.5

Pre-Requisite: Basic Knowledge of Hardware and Programming

Course Objectives: Students will be able to

- Hands on practice on IoT hardware and software platforms, microcontrollers and single board computers.
- Detailed study and interfacing of sensors, actuators and communication modules to microcontrollers and single board computers.
- Analyze the Application areas of IoT.
- Development of different IoT applications.

Course Outcomes: Students will be able to

CO1 Analyze the application areas of IOT

CO2 Realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.

CO3 Analyze the building blocks of Internet of Things and characteristics.

CO4 Design and develop IoT applications for given specific problem statement

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	-	3	-	3	-	-	2	-	2	-	2	2	-	-
CO2	2	-	3	-	3	-	-	2	-	2	-	2	2	2	
CO3	2	-	3	-	3	-	-	2	-	2	-	2	2	-	-
CO4	2	-	3	-	3	-	-	2	-	2	-	2	2	2	-

List of Experiments

Week #	Name of the Experiment	Specific Requirements
1.	**Arduino Uno Development Kit:** Familiarization with **Arduino Uno** hardware, software, and perform necessary software installation.	Arduino Uno hardware and software platforms
2.	**Outputting Digital Signal:** a) Interface **LED/Buzzer** with Arduino Uno and write a program to turn ON LED for 1 sec after every 2 seconds. b) Interface **Buzzer** with Arduino Uno and write a program to turn ON sound by Buzzer for 2 seconds.	Arduino Uno (1), LED (2), and Buzzer (1)
3.	**Inputting Digital Signal:** a) Interface push button and LED with Arduino Uno and write a program to turn ON **LED** when push button is pressed. b) Interface digital sensor (**IR-infrared sensor**) with Arduino Uno and write a program to turn ON Sound by **Buzzer** when object detects.	Arduino Uno (1), Push buttons(2), LED (2), Buzzer (1), and IR sensor module (1)
4.	**Inputting Analog Signal:** a) Interface **Potentiometer** with Arduino Uno and	Arduino Uno (1), Potentiometer (1),

	write a program to increase and decrease light intensity of LED. b) Interface **LDR light sensor** with Arduino and write a program to control LED.	LED (2), and LDR sensor module (1)
5.	**Reading and Writing Data:** Interface **4 x 4 keypad and LCD** display with Arduino Uno and write a program to display pressed value on LCD.	Arduino Uno (1), 4 x 4 key pad (1), and LCD display (1)
6.	**NodeMCU:** a) Familiarization with **NodeMCU** hardware, software, and perform necessary software installation. b) Interface **RGB LED** with NodeMCU and write a program to turn ON/OFF different colors for 2/3 seconds.	NodeMCU hardware, software platforms, and RGB LEDs (1)
7.	**Web Server:** Interface **motor using relay** with NodeMCU and write a program to turn ON/OFF motor with help of relay when button is pressed from server web page.	NodeMCU (1), dc motor (1), 2 channel relay (1), and motor driver (1)
8.	**Raspberry Pi:** Familiarization with single board computer (SBC), **Raspberry Pi** hardware, software, and perform necessary software installation.	Raspberry Pi hardware and Python software
9.	**Radio Frequency Identification (RFID):** Interface **RFID** with Raspberry Pi and write a program to print tag information (accept/reject) on OLED display.	Raspberry Pi (1), RFID reader module (1), RFID tags (3), OLED module(1)
10.	**Short Range Communication:** Interface **Bluetooth** and **heart beat rate sensor** with Raspberry Pi and write a python program to send beats per minute (BPM) rate to smart phone using Bluetooth.	Raspberry Pi (1), Blutooth module (2), heart beat sensor module (1), and smart phone (1).
11.	**Cloud Communication:** a) Interface **DHT11 sensor** and write a python program on Raspberry Pi to upload temperature and humidity data to thingspeak cloud. b) Interface **DHT11 sensor** and write a program on Raspberry Pi to retrieve temperature and humidity data from thingspeak cloud.	Raspberry Pi (1), temperature and humidity(DHT11) sensor module (1), and library thingspeak cloud
12.	**Machine-to-Machine (M2M) Protocol:** a) Write a program on Raspberry Pi to publish temperature and humidity data to **MQTT** broker. b) Write a program on Raspberry Pi to subscribe to **MQTT** broker for temperature and humidity data and print it.	Raspberry Pi (1), temperature and humidity(DHT11) sensor module (1), and library of MQTT
Add on Experiments		
13.	**GSM and GPS:** Interface **GSM** and **GPS Module** using Arduino/ Raspberry Pi and Write a program to send latitude and longitude of my current location through SMS.	Arduino/ Raspberry Pi and GSM and GPS Module(1)
14.	**Line of Site Communication:** Interface **Zigbee communication module** with Arduino/ Raspberry Pi and write a program to check	Arduino/ Raspberry Pi (1) and Zigbee communication

	the communication between two zigbee modules.	module (2)
15.	**Long Range Peer to Peer Communication:** Interface **LoRa (Long Range)** with with Arduino/ Raspberry Pi and write a program to send the temperature and humidity data from one LoRa module to other LoRa module.	Arduino/ Raspberry Pi (1) and LoRa (Long Range) module (2)

Text Books : Vijay Madisetti, Arshdeep Bahga," Internet of Things A Hands-On-Approach", 1st edition, Orient Blackswan Private Limited,2014.

References : 1. Adrian McEwen, "Designing the Internet of Things", 1st edition, Wiley Publishers, 2013.
2. Daniel Kellmereit, "The Silent Intelligence: The Internet of Things",1st edition, DND Ventures LLC, 2013.

Business Intelligence Lab

(Job Oriented Elective Lab – II)

III B.Tech – VI Semester (Code: 20DSL603/JOL2C)

Lectures:	0 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	1.5

Pre-Requisite: None

Course Objectives: Students will be able to

- Use Power BI for end-to-end business intelligence workflows.
- Clean, transform, and model data using Power Query and DAX.
- Build dashboards and interactive reports.
- Apply AI tools in Power BI for automated insight generation.

Course Outcomes: Students will be able to

CO1 Understand Power BI interface and import data from multiple sources.
CO2 Perform cleaning, preprocessing, and transformations using Power Query.
CO3 Build data models and analytical measures using DAX.
CO4 Create dashboards, configure interactivity, and apply AI-based insights.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1	3	-	3	-	-	-	-	-	-	1	3	3	3
CO2	1	1	3	-	3	-	-	-	-	-	-	1	3	3	3
CO3	1	1	3	-	3	-	-	-	-	-	-	1	3	3	3
CO4	1	1	3	-	3	-	-	-	-	-	-	1	3	3	3

List of Experiments

1. Import Data from Text, CSV, Excel, JSON; perform dataset overview and profiling.
2. Handle missing values and transform data using Power Query.
3. Perform column operations: Extract, Format, Parse; import from Web or XML.
4. Apply Group By, Aggregation, Nested Groups, and Apply transformations.
5. Create visualizations: Bar, Line, Pie, Histogram, KPI.
6. Create advanced visuals: Tree Map, Waterfall, Funnel, Map, Matrix.
7. Use AI Visuals: Key Influencers, Decomposition Tree, Anomaly Detection.
8. Create DAX Calculated Columns and Measures.
9. Build interactive dashboards: Slicers, Drill-down, Drill-through, Bookmarks.
10. Publish reports to Power BI Service and configure dataset refresh.
11. Generate AI narratives using Smart Narratives and Q&A visual.
12. **Case Study:** Complete End-to-End BI Project with automated insights like Retail Sales & Customer Insights Automation

Text Books :

1. **Business Intelligence with Microsoft Power BI** – Packt Publishing / BPB Publications
2. **Business Intelligence Guidebook: From Data Integration to Analytics** – Rick Sherman

References :

Indian Constitution

III B. Tech. – VI Semester (Code: 20DS606/MC04)

Lectures:	2 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	00	Credits:	0.0

Pre-Requisite: None

Course Objectives: Students will be able to

- To understand the importance of the Constitution in a Democratic Society.
- To Understand to Fundamental Rights and make the best use of them and the duties of a citizen and discharge his duties and became a good citizen.
- To know the judicial supremacy and independence of Judiciary and fight for his legitimate Right through Court of Law.
- To participate in Nation building activities and be away from destructive outfits and in the democratic process of governance.

Course Outcomes: Students will be able to

CO1 Able to understand the importance of the constitution in a Democratic Society.

CO2 Comprehend the Fundamental Rights and effectively apply them, while also acknowledging the responsibilities of a citizen, fulfilling those duties, and aspiring to become a responsible citizen

CO3 Know about Judicial supremacy and Independence of judiciary and fight for his legitimate Rights through court of law.

CO4 Participate in nation building activities and be away from destructive outfits and in the democratic process of governance.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	-	-	-	-	-	3	-	-	-	-	-	2	-	-	-
CO2	-	-	-	-	-	3	-	-	-	-	-	2	-	-	-
CO3	-	-	-	-	-	3	-	-	-	-	-	2	-	-	-
CO4	-	-	-	-	-	3	-	-	-	-	-	2	-	-	-

UNIT-1 8 Hours

Meaning of the Constitutional Law and Constitutionalism, Historical perspective of the Constitution of India, Salient features and Characteristics of the Constitution of India, scheme of Fundamental Rights

UNIT-2 8 Hours

The Scheme of the Fundamental Duties and its legal status, The Directive Principles of State Policy- its implementation, Federal structure and distribution of Legislative and Financial powers between the Union and States, Parliamentary form of Government of India – The constitutional Powers and Status of the President of India.

UNIT-3 8 Hours

Amendment of Constitutional powers and procedure, the Historical Perspective of the Constitutional amendments in India, Emergency Provisions: National Emergency, President Rule, Financial Emergency, and Local Self Government – Constitutional Scheme in India

UNIT-4 8 Hours

Scheme of the Fundamental Rights to Equality, Scheme of the Fundamental Right to certain Freedoms under Article 19, Scope of the Right to Life and Personal Liberty under Article 21.

Text Books :
1. Introduction to constitution of India, D.D.Basu, Lexisnexis
2. The constitution of India, P. M. Bhakshi, Universal law publishing

References :

Wireless Networks

Professional Elective – III

IV B. Tech. – VII Semester (Code: 20DS701/PE3A)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Computer Networks (20DS502)

Course Objectives: Students will be able to

- Understand the fundamentals of the wireless communications systems, the wireless network architectures, protocols, and applications.
- Understand architecture of different telecommunication systems and satellitesystems.
- Understand architecture and layers of wireless local area networks and network layer for wireless environment.
- Understand network architectures of 4G and 5G Technology Advancements.

Course Outcomes: Students will be able to

CO1 Develop the foundation for mobile and wireless networks.

CO2 Learn about 2G mobile communication system, DECT, UMTS and LTE Technology, routing, and localization of satellite systems.

CO3 Learn about Wireless LAN architecture and protocols used and Mobile Network Layer.

CO4 Learn the fundamentals of network architecture and evolution of 4G and 5G technology.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	-	-	-	-	-	-	-	-	3	3	3	3
CO2	3	3	3	-	-	-	-	-	-	-	-	3	3	3	3
CO3	3	3	3	-	-	-	-	-	-	-	-	3	3	3	3
CO4	3	3	3	-	-	-	-	-	-	-	-	3	3	3	3

UNIT-1 12 Hours

Introduction: Applications, Short History of Wireless Communications, Simplified Reference Model.

Wireless Transmission: Frequencies, Signals, Signal Propagation, Multiplexing, Modulation, Spread Spectrum, and Cellular Systems.

Medium Access Control: Motivation for a Specialized MAC, SDMA, FDMA, TDMA, CDMA, and Comparison.

UNIT-2 12 Hours

Telecommunication Systems: GSM, DECT, TETRA, UMTS and IMT-2000: System Architecture and Radio Interface.

Satellite Systems: History, Applications, Basics, Routing, Localization, and Handover.

UNIT-3 12 Hours

Wireless LAN: Infrared Vs. Radio Transmission, Infrastructure and Ad Hoc Networks, IEEE 802.11: System Architecture, Protocol Architecture, Physical Layer, MAC Layer, and MAC Management.

Mobile Network Layer: Mobile IP: Entities and Terminology, IP packet delivery, Agent discovery, Registration, and Tunneling and Encapsulation, Dynamic Host Configuration Protocol. Ad Hoc Networks.

UNIT-4 12 Hours

4G and 5G Technology Advancements

Part1: 4G – LTE: Network Architecture, QoS and Bearer Service Architecture.

Part2: 5G: Evolution of LTE Technology to beyond 4G, 5G roadmap, 10 pillars of 5G.

Text Books :

1. Jochen.Schiller, "Mobile communications", second edition, Addison-Wesley, 2003.
2. Farooq Khan, "LTE for 4G Mobile Broadband" Line-Air Interface Technologies and Performance, CAMBRIDGE, 2009.
3. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", WILEY, 2015.

References :

1. William Stallings, "Wireless Communication Networks".
2. UWE Hansmann, Lother Merk, Martin S.Nicklous, Thomas Stober, "Principles of Mobile Computing", 2nd Edition.

Robotic Process Automation

Professional Elective – III

IV B. Tech. – VII Semester (Code: 20DS701/PE3B)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: None

Course Objectives: Students will be able to

- Understand the fundamentals, scope, and techniques of Robotic Process Automation (RPA)
- Understanding of RPA tools, covering user interface navigation, variable and argument management, control flow activities, and data manipulation techniques.
- Advanced knowledge and practical skills in automation concepts, techniques, and tools for effective data handling, web interaction, and process automation using RPA frameworks.
- Design, implement, and manage assistant bots that respond to user and system events while effectively applying debugging and exception-handling techniques for reliable automation.

Course Outcomes: Students will be able to

CO1 Enabling students to identify automation opportunities, comprehend RPA tools and architectures, and apply basic RPA techniques to develop simple automation solutions.

CO2 Navigating the user interface, managing variables and arguments, implementing control flow activities, and applying data manipulation techniques for process automation.

CO3 Apply advanced automation concepts, techniques, and tools to efficiently handle data, interact with web applications, and develop end-to-end process automation solutions using RPA frameworks.

CO4 Gain the ability to design, develop, and manage assistant bots that respond to user and system events, incorporating effective debugging and exception-handling techniques to ensure robust and reliable automation processes.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	-	-	-	-	2	2	-	-	-	-	-	2	3	-
CO2	-	2	2	-	-	2		-	-	-	-	-	2	2	-
CO3	2	2		-	-	-	-	-	-	-	-	-	2	3	-
CO4	2	2	2	-	-	2	2	-	-	-	-	-	3	3	-

UNIT-1 12 Hours

Introduction To Robotic Process Automation: Scope and techniques of automation, Robotic process automation What can RPA do? Benefits of RPA, Components of RPA, RPA platforms, The future of automation. RPA BASICS: History of Automation What is RPA RPA vs Automation Processes & Flowcharts Programming Constructs in RPA What Processes can be Automated Types of Bots Workloads which can be automated RPA Advanced Concepts Standardization of processes RPA Development methodologies Difference from SDLC Robotic control flow architecture RPA business case RPA Team Process Design Document/Solution Design Document Industries best suited for RPA Risks & Challenges with RPA RPA and emerging ecosystem.

UNIT-2 12 Hours

RPA Tool Introduction and Basics : Introduction to RPA Tool - The User Interface - Variables - Managing Variables - Naming Best Practices - The Variables Panel - Generic Value Variables - Text Variables - True or False Variables - Number Variables - Array Variables - Date and Time Variables - Data Table Variables - Managing Arguments - Naming Best Practices - The Arguments Panel - Using Arguments - About Imported Namespaces - Importing New Namespaces- Control Flow - Control Flow Introduction - If Else Statements - Loops - Advanced Control Flow - Sequences - Flowcharts - About Control Flow - Control Flow Activities - The Assign Activity - The Delay Activity - The Do While Activity - The If Activity - The Switch Activity - The While Activity - The For Each Activity - The Break Activity - Data Manipulation - Data Manipulation Introduction - Scalar variables, collections and Tables - Text Manipulation - Data Manipulation - Gathering and Assembling Data

UNIT-3 12 Hours

Advanced Automation Concepts & Techniques: Recording Introduction - Basic and Desktop Recording - Web Recording - Input/Output Methods - Screen Scraping - Data Scraping - Scraping advanced techniques - Selectors - Defining and Assessing Selectors - Customization - Debugging - Dynamic Selectors - Partial Selectors - RPA Challenge - Image, Text & Advanced Citrix Automation - Introduction to Image & Text Automation - Image based automation - Keyboard based automation - Information Retrieval - Advanced Citrix Automation challenges - Best Practices - Using tab for Images - Starting Apps - Excel Data Tables & PDF - Data Tables in RPA - Excel and Data Table basics - Data Manipulation in excel - Extracting Data from PDF - Extracting a single piece of data - Anchors - Using anchors in PDF

UNIT-4 12 Hours

Handling User Events & Assistant Bots, Exception Handling: What are assistant bots? - Monitoring system event triggers - Hotkey trigger - Mouse trigger - System trigger - Monitoring image and element triggers - An example of monitoring email - Example of monitoring a copying event and blocking it - Launching an assistant bot on a keyboard event.

Exception Handling: Debugging and Exception Handling - Debugging Tools - Strategies for solving issues - Catching errors.

Text Books :

1. Alok Mani Tripathi. Learning Robotic Process Automation. Packt, 2018

References :

1. Heidi Jaynes Lauren Livingston Frank Casale, Rebecca Dilla. Introduction to Robotic Process Automation: a Primer. Institute of Robotic Process Automation, 1 edition, 2015
2. Richard Murdoch. Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks and Become An RPA Consultant. Independently Published, 1 edition, 2018
3. Srikanth Merianda. Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation. Consulting Opportunity Holdings LLC, 1 edition, 2018

Social Network Analysis

Professional Elective – III

IV B.Tech – VII Semester (Code: 20DS701/PE3C)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Machine Learning (20DS602)

Course Objectives: Students will be able to

- Understanding the motivations behind the study of social network analysis
- Relate the physical society with the online social network and understand how one shapes the other.
- Interpret the historical development of social network analysis research
- Classify the hierarchy of social structure and the terminologies needed to model the structure.

Course Outcomes: Students will be able to:

CO1 Discuss the Networks Society and Network Measures.
CO2 Demonstrate the Network Growth Models and Link Analysis.
CO3 Classify the Community Structure in Networks.
CO4 Demonstrate the Behavior of Social Network Effects.

Mapping of Course Learning Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1	-	2	-	2	-	-	-	-	-	-	1	-	-
CO2	1	2	-	2	1	-	1	1	-	-	-	-	1	1	-
CO3	2	2	-	1	1	1	1	-	-	-	-	-	1	-	1
CO4	2	2	-	1	1	1	1	-	-	-	-	-	1	2	1

UNIT-1 (12 Hours)

Networks and Society: What is Social Network Analysis?, Why do We Study Social Networks, Applications of Social Network Analysis, Preliminaries, Three Levels of Social Network Analysis, Historical Development, Graph Visualization Tools**.**

Network Measures: Network Basics, Node Centrality, Assortativity, Transitivity and Reciprocity, Similarity, Degeneracy.

UNIT-2 (12 Hours)

Network Growth Models: Properties of Real-World Networks, Random Network Model, Ring Lattice Network Model, Watts–Strogatz Model, Preferential Attachment Model, Price's Model, Local-world Network Growth Model, Network Model with Accelerating Growth, and Aging in Preferential Attachment.

Link Analysis: Applications of Link Analysis, Signed Networks, Strong and Weak Ties, Link Analysis Algorithms, Page Rank, Personalised Page Rank, DivRank, SimRank, PathSIM

UNIT-3 (12 Hours)

Community Structure in Networks: Applications of Community Detection , Types of Communities, Community Detection Methods, Disjoint Community Detection, Overlapping Community Detection, Local Community Detection, Community Detection vs Community Search, Evaluation of Community Detection Methods

Link Prediction: Applications of Link Prediction, Temporal Changes in a Network ,Problem , Evaluating Link Prediction Methods, Heuristic Models, Probabilistic Models, Supervised Random Walk, Information-theoretic Model, Latest Trends in Link Prediction,

UNIT-4 (12 Hours)

Cascade Behaviours and Network Effects: Preliminaries and Important Terminologies, Cascade Models, Case Study – The "Indignados" Movement, Probabilistic Cascades,Epidemic Models, Independent Cascade Models, Anomaly Detection in Networks, Graph Representation Learning

Text Books :
1. Social Network Analysis, Tanmoy Chakraborty, Wiley, 2021
2. Network Science, Albert-Lazzlo Barabas

References :
1. Social Network Analysis: Methods and Applications, Stanley Wasserman, Katherine Faus.

Artificial Neural Networks & Deep Learning

Professional Elective – IV

IV B. Tech. – VII Semester (Code: 20DS702/PE4A)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Machine Learning (20DS602)

Course Objectives: Students will be able to

- Design an ANN model for identifying complex decision boundaries
- Design a CNN model for Computer Vision applications.
- Apply sequence models to natural language processing tasks.
- Model the structure in the existing data to generate new data samples.

Course Outcomes: Students will be able to

CO1 Design and implement a Neural Network for classification.

CO2 Create a Convolutional Neural Network for image classification.

CO3 Model a Recurrent Neural Network and Long Short Term Memory Network for text processing.

CO4 Design and implement an Encoder and Decoder model.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3	-	-	-	-	-	-	2	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	-	2	3	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-	2	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	-	2	3	3	3

UNIT-1 12 Hours

Artificial Neural Networks : Sigmoid neuron, Feedforward neural networks, activation functions, backpropagation algorithm, loss functions, Gradient Descent - Stochastic Gradient Descent (SGD), Mini Batch Stochastic Gradient Descent (MB-SGD), Optimization methods - SGD with momentum, Adaptive Gradient (AdaGrad), RMSprop, Adam, Regularization - dropout. Demonstration of ANN using TensorFlow.

UNIT-2 12 Hours

Convolutional Neural Networks : Convolution, filters, stride, padding, feature maps, Architecture of CNNs - input layer, convolutional layers, activation functions, pooling layers, fully connected layers, output layer, training, transfer learning, image classification. TensorFlow demonstration.

UNIT-3 12 Hours

Sequence Models: Introduction to Sequence Modeling, word embeddings, Recurrent Neural Networks (RNNs) - Basic architecture of RNNs, Language model and sequence generation, Sentiment analysis using TensorFlow, Long Short-Term Memory (LSTM).

UNIT-4 12 Hours

Generative Models: Autoencoders, Architecture and training of autoencoders for unsupervised representation learning, Variational Autoencoders (VAEs), The encoder-decoder framework and the reparameterization for generating new samples.

Text Books:

1. Francois Chollet, Deep Learning with Python, Manning publishers, O'Reilly publishers, First Edition, ISBN- 9781617294433
2. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, Third Edition, ISBN- 9355421982

References:

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, First Edition, ISBN- 978-0262035613.
2. Neural Networks and Deep Learning, Michael Nielsen, online free-book.

Video Lecture Series:

3. Deep Learning Course-106106184, Part-1, NPTEL, Prof. Mitesh M. Kapra
4. Deep Learning Course- 106106201, Part-2, NPTEL, Prof. Mitesh M. Kapra
5. Deep Learning Course -106105215, NPTEL, Prof. Prabir Kumar Biswas
6. CS230 - Deep Learning - Stanford University.
7. 6.S191 - Introduction to Deep Learning – MIT.
8. CS224N - Natural Language Processing with Deep Learning - Stanford University.

Natural Language Processing

Professional Elective – IV

IV B. Tech. – VII Semester (Code: 20DS702/PE4B)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Compiler Design (20DS601), Machine Learning (20DS602)

Course Objectives: Students will be able to

- Get familiarized with the concepts and techniques of Natural language Processing for analyzing words based on Morphology and CORPUS.
- Make them understand the concepts of morphology, syntax, semantics and pragmatics of the language and that they are able to give the appropriate examples that will illustrate the above mentioned concepts.
- Recognize the significance of pragmatics for natural language understanding.
- Be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

Course Outcomes: Students will be able to

CO1 Apply the principles and processing of natural language processing using computers and create CORPUS linguistics based on digestive approach

CO2 Analyze the syntax, semantics and pragmatics of a statement written in a natural language and perform POS tagging for a given natural language.

CO3 Demonstrate the techniques for the text-based processing of natural language with respect to morphology.

CO4 Elaborate the feature engineering techniques needed for real time implementation of various natural language applications.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	2	2	3	3	-	-	-	-	-	-	2	2	3	3
CO2	-	2	2	3	3	-	-	-	-	-	-	2	3	3	3
CO3	-	2	2	3	3	-	-	-	-	-	-	2	3	3	3
CO4	-	2	2	3	3	-	-	-	-	-	-	2	3	3	3

UNIT-1 12 Hours

Basics of NLP: - Evolution of Human Language, Text Mining, Need of Text Mining, Text Mining & Natural Language Processing, Basic Structure of a NLP Application, Understanding basic applications, Advantages of togetherness-NLP and Python.

Corpus Analysis: - What is a corpus? Why do we need a corpus? Understanding corpus analysis, Understanding types of data attributes Exploring different file formats for corpora.

UNIT-2 12 Hours

Understanding the Structure of a Sentence: - Understanding components of NLP, Natural language understanding, Defining context-free grammar, Morphological analysis, Syntactic analysis, Semantic Analysis, Ambiguity, Handling Ambiguity, Discourse integration, Pragmatic analysis

UNIT-3 12 Hours

Preprocessing: - Handling corpus-raw, Handling corpus-raw sentences, Basic preprocessing, Practical and customized preprocessing.

UNIT-4 12 Hours

Feature Engineering and NLP Algorithms:- Understanding feature engineering, Basic feature of NLP, Basic statistical feature of NLP, Advantages of features engineering, Challenges of features engineering.

Text Books:

1. Python Natural Language Processing (Packt Publishers) Author: Jalaj Thanaki

References:

2. Natural Language Processing (Oxford Publishers) Author: Tanvir Siddiqui

Digital Forensics

Professional Elective – III

IV B. Tech. – VII Semester (Code: 20DS702/PE4C)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Computer Networks (20DS502), Database Management System (20DS403)

Course Objectives: Students will be able to

- Identify different techniques of data acquisition in Digital Forensics, Prepare for investigation process
- Analyze Crime & Incident Scenes using Windows Forensics, Process Log & Event analysis
- Investigate Network, Wireless & Web attacks,
- Process E-mail, Mobile Device attack incidents.

Course Outcomes: Students will be able to

CO1 Identify different techniques of data acquisition in Digital Forensics, Prepare for investigation process

CO2 Analyze Crime & Incident Scenes using Windows Forensics, Process Log & Event analysis

CO3 Investigate Network, Wireless & Web attacks,

CO4 Process E-mail, Mobile Device attack incidents.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	2	2	3	3	3	-	2	2	-	-	2	3	2	2
CO2	2	2	2	3	3	3	-	2	2	-	-	2	3	2	2
CO3	2	2	2	3	3	3	-	2	2	-	-	2	3	2	2
CO4	2	2	2	3	3	3	-	2	2	2	-	2	3	2	2

UNIT-1 12 Hours

Introduction To Digital Forensic: Introduction, Evolution of Computer Forensics, Stages of Computer Forensics Process, Benefits of Computer Forensics, Uses of Computer Forensics, Objectives of Computer Forensics, Role of Forensics Investigator, Forensics Readiness.

Computer Forensics Investigation Process: Introduction to Computer Crime Investigation, Assess the Situation, Acquire the Data, Analyze the Data, Report the Investigation.

Digital Evidence And First Responder Procedure: Digital Evidence, First Responder Toolkit, Issues Facing Computer Forensics, Types of Investigation, Techniques of Digital Forensics.

UNIT-2 12 Hours

Windows Forensics: Introduction, Recovering Deleted Files and Partitions, More about Recovering Lost Files/Data

Logs & Event Analysis And Password Cracking: Introduction, Windows Registry, Windows Event Log File, Windows Password Storage, Application Passwords Crackers

UNIT-3 12 Hours

Network Forensics: Introduction, Network Components and their Forensics Importance, OSI, Forensics Information from Network, Log Analysis, Forensics Tools.

Wireless Attacks: Introduction, Wireless Fidelity (Wi-Fi) (802.11), Wireless Security, Wireless Attacks Detection Techniques, Wireless Intrusion Detection Systems.
Investigating Web Attacks: Introduction, Types of Web Attacks, Web Attack Forensics, Web Application Forensics Tools

UNIT-4 12 Hours

Investigating Email Attacks: Introduction, Email Attacks and Crimes, Privacy in Emails, Email Forensics, Email Forensic Tools.
Mobile Device Forensics: Introduction, Challenges in Mobile Forensics, Mobile Communication, Evidences in a Mobile Device, Mobile Forensic Process, Forensic Acquisition Tools

Text Books:

1. DIGITAL FORENSICS by Dr. Jeetedra Pande, Dr. Ajay Prasad, Uttarakhand Open University, 2016.

Reference Books:

1. The basics of digital Forensics (Latest Edition) – The primer for getting started in digital forensics by John Sammons – Elsevier Syngress Imprint
2. Cyber Security – Understanding of cybercrimes, computer forensics and Legal perspectives by Nina Godbole and Sunit Belapure – Wiley India Publication

e-Learning Resources:

1. https://nptel.ac.in/
2. https://www.coursera.org/
3. Ministry of Electronics and Information Technology (MeitY) – Govt of India – Information Security Project – https://www.infosecawareness.in/

Cloud Programming

Job Oriented Elective – III

IV B. Tech. – VII Semester (Code: 20DS703/JO3A)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Problem Solving using Programming (20DS203), Object Oriented Programming (20DS303), Operating Systems (20DS304), Computer Networks (20DS502), Web Technologies (20DS402).

Course Objectives: Students will be able to

- Understand the Cloud Computing environment, Windows Azure platform, and Azure websites service.
- Configure Visual Studio with Azure SDK, develop applications to demonstrate Azure storage services – Blob, Table, Queue and Files. Learn the concept of Azure storage Security.
- Demonstrate the concepts of Azure Virtual Machines and Azure Virtual Networks, Azure SQL.
- Learn Service Bus, Azure Active Directory, Azure Key Vault.

Course Outcomes: Students will be able to

CO1	Configure visual studio with Azure SDK. Understand the basics of cloud computing, design and deploy ASP .NET web forms and MVC web sites to Azure cloud environment using VS.
CO2	Design cloud service applications to demonstrate Azure storage services-Blob table queue and files.
CO3	Create and configure Azure virtual machines, Azure virtual networks and Azure SQL.
CO4	Write c# applications to access service bus.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	3	-	3	-	-	-	-	-	-	2	3	3	3
CO2	3	2	3	-	3	-	-	-	-	-	-	2	3	3	3
CO3	3	2	3	-	3	-	-	-	-	-	-	2	3	3	3
CO4	3	2	3	-	3	-	-	-	-	-	-	2	3	3	3

UNIT-1 12 Hours

Introduction to Cloud Computing & Windows Azure Platform – What is Azure?, Overview of Cloud Computing, Comparison of on-premises versus Azure, Service models, Deployment models, Azure services, Azure Resource Manager, Azure subscriptions, Azure registration, Exploring Management portal.

Windows Azure Websites – Visual Studio – Introduction to .NET Framework, Introduction to ASP.NET, Razor syntax, Forms and validation, Working with data, Creating and publishing simple and database driven ASP.NET web sites.

UNIT-2 12 Hours

Cloud Applications - Software Development Kits, Windows Azure Tools for Visual Studio, Cloud Project with a Web Role, Deployment to Windows Azure, Configuration and Upgrading, Service Definition File, Service Configuration File and Role Properties. Cloud applications using ASP.NET.

Windows Azure Storage - Local Storage Vs Azure Storage, Windows Azure Storage Account, Windows Azure Management Tool, Blobs, Tables, Queues, Files. Worker Roles - Queue Service.
Security and Azure Storage - Securing your storage account, Securing access to your data, Securing your data in transit, Encryption at rest, Using Storage Analytics to audit access, Using Cross-Origin Resource Sharing (CORS).

UNIT-3 12 Hours

Virtual Machines – Introduction to Azure Virtual Machine, Virtual machine models, Virtual machine components, Virtual Machine creation, connecting to a virtual machine, configuring and managing virtual machine, scaling Azure virtual machine, Installing SQL server and J2EE Platform, Connecting to SQL Server on Virtual Machine.
Azure Virtual Networks – Introduction, Network Security Groups, Cross-premises connection options, Point-to-site network.
Azure SQL – Azure SQL Features, Database Server Creation in the Cloud, Azure SQL Relational Engine Features, Azure SQL Access, Existing Database Migration, Applications connecting to SQL Azure.

UNIT-4 12 Hours

Service Bus - Service Bus, Relayed messaging, Brokered Messaging- Queues, Topics.
Azure Active Directory - Overview of Azure Active Directory, Creating a directory, Users and groups, Multi-Factor Authentication, Application gallery.
Azure Key Vault - Basic concepts, Terminology used in Azure Key Vault, Ways to access Keys and Secrets in a Key Vault, Steps to authenticate an application with the Key Vault, Benefits of using Azure Key Vault.

Text Books :

1. Windows Azure Technical Documentation Library-MSDN-Microsoft. (msdn.microsoft.com/en-us/library/windowsazure)
2. Lydford, Steve. Building ASP. NET web pages with Microsoft WebMatrix. Apress, 2012.
3. Collier, Michael, and Robin Shahan. Microsoft Azure Essentials-Fundamentals of Azure. Microsoft Press, 2015.
4. https://www.encryptionconsulting.com/introduction-to-azure-key-vault/

References :

1. C# 4.0 The Complete Reference by Herbert Schildt, Tata McGraw Hill, 2010.
2. Beginning ASP.NET 4.5 in C#‖, Matthew MacDonald, Apress Publishing Company.
3. Moroney, Laurence. Introducing Microsoft® WebMatrixTM. " O'Reilly Media, Inc.", 2011.
4. Brunetti, Roberto. Windows Azure step by step. Microsoft Press, 2011.
5. Krishnan, Sriram. Programming Windows Azure: Programming the Microsoft Cloud. " O'Reilly Media, Inc.", 2010.

Cyber Security

Job Oriented Elective – III

IV B. Tech. – VII Semester (Code: 20DS703/JO3B)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Operating Systems(20DS304), Computer Networks(20DS502), Cryptography & Network Security(20DS603).

Course Objectives: Students will be able to

- To make the students familiar with Security services and Security mechanisms and Hacking phases.
- Understand about Security in the networks how to analyze.
- Understand how to secure computer system with using various techniques.
- Gather the matter about how to secure applications in the computer system

Course Outcomes: Students will be able to

CO1	Analyze the hacking and types of hacking and their phases
CO2	Practice different information gathering tools, and different types of attacks and their security for computer networks
CO3	Apply various techniques to secure the computer system
CO4	Modify security feature to computer application with using different methodologies to improve security

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	2	3	-	3	3	-	3	-	-	-	2	2	2	2
CO2	2	2	3	-	3	3	-	3	-	-	-	2	2	2	2
CO3	2	2	3	-	3	3	-	3	-	-	-	2	2	2	2
CO4	2	2	3	-	3	3	-	3	-	-	-	2	2	2	2

UNIT-1 12 Hours

Hacking Essential Terminology: Information Security, Cyber Security, Threat, Vulnerability, Exploit, Hackers Motives and Objectives, Penetration Testing and Hacker classes.

Hacking Phases: Foot printing Methodology, Network Scanning and Enumeration.

UNIT-2 12 Hours

Security of Computer Networks: Information gathering tools, Sniffing and eavesdropping, Spoofing, Session hijacking and Man-in-the-Middle attack, DNS and ARP poisoning, Distributed-Denial-of-Service attacks, Firewall and IDS attacks.

UNIT-3 12 Hours

Security of Computer Systems: Malware attacks, Password attacks, Denial-of-Service attacks, Unauthorized access, Privilege escalation, Backdoor attacks.

UNIT-4 12 Hours

Security of Applications: Improper data / Input validation, Authentication and Authorization attacks, Security misconfiguration, Information disclosure, Buffer overflow

issues, Broken session management, SQL injection, Improper error handling and exception management.

References :

1. CISSP All-in-One Exam Guide, Seventh Edition 2016 by Shon Harris and Fernando Maymi McGraw- Hill Education.
2. Gray Hat Hacking: The Ethical Hackers Handbook 3rd Edition by Allen Harper, Shon Harris McGraw- Hill Education.

Big Data Analytics

Job Oriented Elective – III

IV B. Tech. – VII Semester (Code: 20DS703/JO3C)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: Problem Solving using Programming (20DS203), Object Oriented Programming (20DS303), Database Management System(20DS403)

Course Objectives: Students will be able to

- Understanding Big data, Hadoop and Hadoop Distributed File System.
- Understanding YARN(Yet Another Resource Node), Map Reduce mechanism.
- Understanding PIG, HIVE.
- Understanding SQOOP, SPARK.

Course Outcomes: Students will be able to

CO1 Identify Hadoop, the distributed file system in Hadoop, and big data.
CO2 Recognize the Map Reduce and YARN (Yet Another Resource Node) mechanisms.
CO3 Integrate PIG and HIVE.
CO4 Recognize SQOOP and SPARK.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3

UNIT-1 12 Hours

Big Data Analytics: Introduction to Big Data Analytics, Characteristics of Big Data, Sources of Big Data, Applications of Big Data.

HADOOP: Introduction to Hadoop, Hadoop components, Configuration of Hadoop.

The Hadoop Distributed File System: The design of HDFS,HDFS concepts, The command line interpreter, Basic File system operations, Hadoop File System, Interfaces Data flow, parallel copying with distcp.

UNIT-2 12 Hours

YARN: Anatomy of YARN application run, YARN compared to Map Reduce 1, Scheduling in YARN.

How Map Reduce Works: Anatomy of Map Reduce job run, Failures, Shuffle and sort, Task execution.

Map Reduce Features-Counters, sorting, joins side data distribution, Writing map reduce programs, deploying map reduce programs on Hadoop Cluster.

UNIT-3 12 Hours

Installing and Running Pig-Execution Types, Running Pig Programs, Grunt, Pig Latin Editors, An Example, Comparison with Databases, Pig Latin-Structure, Statements, Expressions, Types, Schemas, Functions, Macros, User-Defined Functions-A Filter UDF, An Eval UDF, Data Processing Operators- Loading and Storing Data, Filtering Data, Grouping and Joining Data,

Sorting Data, Combining and Splitting Data, Pig in Practice-Parallelism, Anonymous Relations, Parameter Substitution.

Installing Hive, The Hive Shell, An example, Running Hive, Configuring Hive, Hive Services, The Metastore, Comparison with traditional databases, Schema on Read versus Schema on Write, Update, transactions and Indexes, SQL on Hadoop alternatives, HiveQL, Data types, Operators and functions, Tables, Querying Data-sorting and aggregating, MapReduce Script, joins, Sub queries, Views.

UNIT-4 12 Hours

Spark: Installing spark, an example spark application, jobs, stages, tasks, a scalastand alone application, anatomy of spark job run, job submission, DAG construction, task scheduling, task execution, execution cluster managers, spark on YARN.

Sqoop: Getting Sqoop, Sqoop Connectors, A Sample Import, Text and Binary File Formats, Generated Code, Additional Serialization Systems, Imports: A Deeper Look, Controlling the Import, Imports and Consistency.

Text Books :
1. HADOOP "The Definitive Guide", Tom White, O'Reilly Publications, 4th Edition.
2. Black Book on Big Data, Dreamtech Publications.

References :
1. Hadoop in Action, Hadoop Beginner's Guide,Optimizing Hadoop for MapReduce, Scaling Big Data with Hadoop and Solr

Open Elective

IV B. Tech. – VII Semester (Code: 20DS704/OE)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

List of Subjects

Department	Code	Name of the Subject
AIML	CM1	Artificial Intelligence
	CM2	Introduction to Machine Learning
CIVIL	CE1	Air Pollution and Control
	CE2	Remote Sensing and GIS
CB	CB1	Digital Forensics
	CB2	Introduction to Information Security and Cyber Laws
CSE	CS1	Database Management Systems
	CS2	Java Programming
DS	DS1	Data Warehousing and Data Mining
	DS2	Social Network Analysis
ECE	EC1	Digital Image Processing
	EC2	Embedded System & Design
EEE	EE1	Non-Conventional Energy Sources
	EE2	Electrical Energy Conservation and Auditing
	EE3	Industrial Electrical Systems
EIE	EI1	Sensors and Signal Conditioning
IT	IT1	Cyber Security
	IT2	Web Technologies
MECH	ME1	Automobile Engineering
	ME2	Renewable energy sources
	ME3	Project Management
	ME4	Entrepreneurship Development
CHEMISTRY	CY1	Chemistry in Space technology
	CY2	Artificial Intelligence in Sustainable Chemistry
	CY3	Material Chemistry in daily life
ENGLISH	EL1	Professional Communication
MATHS	MA1	Graph Theory
	MA2	Linear Algebra
PHYSICS	PH1	Nano-materials and Technology
	PH2	Optoelectronic devices and applications
	PH3	Fiber optics communication
NCC	NCC	National Cadet Corps

Industrial Management & Entrepreneurship Development

IV B. Tech. – VII Semester (Code: 20DS705/ME01)

Lectures:	3 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3

Pre-Requisite: None

Course Objectives: Students will be able to

- To provide students an insight into the concepts of general, scientific management and various forms of business organizations along with awareness about various organization structures
- It aims to provide the students with an understanding of basics of human resource management, marketing management.
- To make the students to understand inventory control concepts, fundamentals of TQM, and supply chain management.
- To provide an understanding of financial management and realize the importance of Entrepreneurship.

Course Outcomes: Students will be able to

CO1	Describe the various functions of the management. Learn various forms and structures of business organizations.
CO2	Understand how resources to be planned and also understand various motivation theories, leadership styles and marketing management.
CO3	Develop knowledge about inventory control. Gain the knowledge on Total quality management and understand supply chain management.
CO4	Grasp complete knowledge on importance of entrepreneurship and ability to understand capital and various types of capital.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	-	-	-	-	-	-	-	-	-	-	3	3	2	-	-
CO2	-	-	-	-	-	-	-	-	-	-	3	3	2	-	-
CO3	-	-	-	-	-	-	-	-	-	-	3	3	2	-	-
CO4	2	3	2	3	-	-	-	-	-	-	3	3	2	-	-

UNIT-1 12 Hours

General Management: Management definition, Functions of Management and Principles of Management.

Scientific Management: Definition, Principles of Scientific Management.

Forms of Business Organization: Choice of form of organization, Salient features of Sole Proprietorship, Partnership, Joint Stock Company: Private Limited and Public Limited companies; Merits and demerits.

Organization: Definition, Line, line and staff, functional and matrix organization, Introduction to Strategic Management: Definition and scope

UNIT-2 12 Hours

Human Resource Management: Functions of HR management, human resource planning, recruitment, selection, placement, training & development and performance appraisal, Motivation theories, leadership styles.

Marketing Management: Concepts of Selling and Marketing, Functions of Marketing, Marketing mix (4 Ps); Advertising and sales promotion; Product life cycle; distribution channels

UNIT-3 12 Hours

Materials Management: Inventory Control, objectives of inventory control, Inventory costs, Basic EOQ model, Model with Price breaks, ABC analysis, FSN Analysis, VED Analysis.

Total Quality Management: Definition of, Importance of quality, Phases of quality management, quality control, Difference between Inspection and Quality control, Components of total quality, Quality Function Deployment

Introduction to Supply Chain Management: Definition, scope of SCM, Drivers of SCM, Advantages, limitations

UNIT-4 12 Hours

Financial Management: Functions of finance, Types of Capital-Fixed and Working Capital, Break Even Analysis.

Entrepreneurship Development: Introduction, Entrepreneurial characteristics, Functions of an Entrepreneur; Factors affecting entrepreneurship; Role of communication in entrepreneurship; Entrepreneurial Development-Objectives, Need of Training for enterprises; Finance for the enterprises.

Text Books :

1. Essentials of Management /Koontz and Heinz Weihrich/ Tata-McGraw-Hill 10th Ed.
2. Manufacturing Organization and Management / Amrine / Pearson Education

References :

1. Management Science, A. R. Aryasri.
2. Industrial Engineering and production management by M Mahajan, Dhanapatrai Publications
3. Marketing Management, Philip Kotler

DevOps

(Skill Advanced Course - II)

IV B. Tech. – VII Semester (Code: 20DSL701/SOC5)

Lectures:	2 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	3.5

Pre-Requisite:

Course Objectives: Students will be able to

- Understand the concepts of DevOps and version control.
- Apply Continuous Integration process.
- Apply Continuous delivery process.
- Apply Configuration management Tools.

Course Outcomes: Students will be able to

CO1	Understand Version Control using git and github.
CO2	Use tools like Jenkins for Continuous Integration.
CO3	Use tools like Docker for Continuous Delivery.
CO4	Use tools like Ansible & Kubernetes for Configuration management and Continuous Delivery.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	-	2	-	2	3	-	-	-	3	3	3	2	2	2	3
CO2	-	3	3	2	3	-	-	-	3	2	3	2	3	3	2
CO3	-	3	3	2	3	-	-	-	3	2	3	2	3	3	2
CO4	2	2	-	-	3	-	-	-	3	2	2	2	2	-	-

UNIT-1 8 Hours

DevOps Basics & Version Control: Definition of DevOps, DevOps Stakeholders, DevOps goals, DevOps life cycle.

Version Control, Continuous Integration, Continuous Delivery, Continuous Deployment, Continuous Monitoring.

Git basics, Git features, installing Git, Git essentials, common commands in Git, working with remote repositories using GitHub.

List of Experiments

1. Demonstrate Deploying an Application to GitHub.
2. Demonstrate working with Git Shell commands.
3. Demonstrate working with remote repositories.

UNIT-2 8 Hours

Continuous Integration using Jenkins: Introduction-Understanding Continuous Integration, introduction about Jenkins, Build Cycle, Jenkins Architecture, installation, Jenkin management. Adding a slave node to Jenkins, Building Delivery Pipeline, and Pipeline as a Code.

List of Experiments

1. Demonstrate creation of maven application.
2. Demonstrate Building Delivery Pipeline (Continuous Integration) using Jenkins.

UNIT-3 8 Hours

Continuous Delivery: Containerization with Docker.

List of Experiments

1. Demonstrate Containerization with Docker.

UNIT-4 8 Hours

Continuous Delivery: Configuration management, and application deployment functionality using Ansible, Containerization using Kubernetes.

List of Experiments

1. Demonstrate CI/CD job to build code on ansible and deploy it on container.
2. Demonstrate Containerization with Kubernetes.

Text Books :
1. Patrick Debois Gene Kim, Jez Humble and John willis. The DevOps Handbook. IT Revolution Press,LLC, 1 edition, 2016. ISBN 978-1942788003

References :
1. Jennifer Davis & Ryn Daniels. Effective DevOps. Oreilly publications, 1 edition, 2018. ISBN 978- 1-492-07309-3
2. George Spafford Gene Kim, Kevin Bher. CThe Phonex Project. IT Revolution, 1 edition, 2018. ISBN 978-194278294.

Cloud Programming Lab

(Job Oriented Elective Lab – 3)

IV B. Tech. – VII Semester (Code: 20DSL702/JOL3A)

Lectures:	0 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	1.5

Pre-Requisite: Problem Solving using Programming Lab (20DSL203), Object Oriented Programming Lab (20DSL303)

Course Objectives: Students will be able to

- Understand the Cloud Computing environment, Windows Azure platform, and Azure websites service.
- Configure Visual Studio with Azure SDK, develop applications to demonstrate Azure storage services – Blob, Table, Queue and Files. Learn the concept of Azure storage Security.
- Demonstrate the concepts of Azure Virtual Machines and Azure Virtual Networks, Azure SQL.
- Learn Service Bus, Azure Active Directory, Azure Key Vault.

Course Outcomes: Students will be able to

CO1 Configure Visual Studio with Azure SDK. Understand the basics of Cloud computing, design and deploy ASP.NET Razor Pages websites to Azure Cloud Environment using Visual Studio.

CO2 Design Cloud Service applications to demonstrate Azure storage services – Blob, Table, Queue and Files.

CO3 Create and configure Azure Virtual Machines, Azure Virtual Networks, and Azure SQL.

CO4 Write C# applications to access Service Bus.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO2	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO3	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3
CO4	3	3	3	-	3	-	-	2	-	2	-	3	3	3	3

List of Experiments

1. Create Azure Student subscription and explore the Azure management portal.
2. Design an ASP.NET MVC website to perform CRUD operations on a SQL Server database with search option and validation.
3. Design Cloud Service with WebRole to demonstrate Windows Azure Blob Storage.
4. Design Cloud Service with WebRole to demonstrate Windows Azure Table Storage.
5. Design Cloud Service with WebRole and WorkerRole to demonstrate Windows Azure Queue Storage.
6. Design Cloud Service to demonstrate Windows Azure Files Storage.
7. Create Azure Virtual Machine and configure with Microsoft SQL Server, and J2EE platform to host web applications.
8. Design a Cloud service (or) C# Console Application to access Virtual Machine SQL Server database.

9. Design Cloud Service (or) C# Console Application to access Azure SQL.
10. Write C# Console Application to implement Service Bus Relayed Messaging.
11. Write C# Console Application to implement Service Bus Brokered Messaging using Queues.
12. Write C# Console Application to implement Service Bus Brokered Messaging using Topics.

Text Books :

1. Windows Azure Technical Documentation Library-MSDN-Microsoft. (msdn.microsoft.com/en-us/library/windowsazure)
2. Lydford, Steve. Building ASP. NET web pages with Microsoft WebMatrix. Apress, 2012.
3. Collier, Michael, and Robin Shahan. Microsoft Azure Essentials-Fundamentals of Azure. Microsoft Press, 2015.

References :

1. C# 4.0 The Complete Reference by Herbert Schildt, Tata McGraw Hill, 2010.
2. Beginning ASP.NET 4.5 in C#‖, Matthew MacDonald, Apress Publishing Company.
3. Moroney, Laurence. Introducing Microsoft® WebMatrixTM. " O'Reilly Media, Inc.", 2011.
4. Brunetti, Roberto. Windows Azure step by step. Microsoft Press, 2011.
5. Krishnan, Sriram. Programming Windows Azure: Programming the Microsoft Cloud. " O'Reilly Media, Inc.", 2010.

Cyber Security Lab

(Job Oriented Elective Lab – 3)

IV B. Tech. – VII Semester (Code: 20DSL702/JOL3B)

Lectures:	0 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	1.5

Pre-Requisite: Operating Systems(20DS304), Computer Networks(20DS502), Cryptography & Network Security(20DS603)

Course Objectives: Students will be able to

- Learn the Installations of different Tools (VMWare, Kali Linux, Windows OS, Metasploitable2, Veil frame work and DVWA).
- Understand the usage of Information Gathering and MITMF tools. Learn how to detect/prevent intrusions in system by using snort and configuring firewall Settings using IPtables,
- Learn how to hack a system and gathering information of a system using metasploit frame work and meterpreter shell commands, mechanisms for cracking passwords and wireless network attacks.
- Understand the usage of the Web application hijacking tools, DOS, Sql-injection, XSS and Phishing attacks.

Course Outcomes: Students will be able to

CO1 Install the different Tools (VMWare, Kali Linux, Windows OS, Metasploitable2, Veil framework and DVWA).

CO2 Test the Information Gathering and MITMF tools, Detect/prevent intrusions in system by using snort and configure firewall Settings using IPtables.

CO3 Practice the hacking and gathering information of a system using metasploit frame work and meterpreter shell commands, password cracking & wireless network attacks.

CO4 Test the Web application hijacking tools, DOS, Sql-injection, XSS and Phishing attacks.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	2	3	-	3	3	-	2	-	2	-	2	2	2	2
CO2	2	2	3	-	3	3	-	2	-	2	-	2	2	2	2
CO3	2	2	3	-	3	3	-	2	-	2	-	2	2	2	2
CO4	2	2	3	-	3	3	-	2	-	2	-	2	2	2	2

List of Experiments

1. Installations: - VM-ware, kali, windows OS, metaspotiable-2, DVWA.
2. Information Gathering Tools:- a) Recon-ng b) Nmap c) Dmitry d) Netdiscover
3. Session hijacking, Man in The Middle (MTM) Attack.
4. Linux Firewall rules configuration by Iptables.
5. Snort installation and usage in
   a) Packet Sniffer mode
   b) Packet Logger mode
   c) IDS mode
   d) IPS mode
6. Hacking any windows OS by using Malware.

7. Password Attacks:-
   a) Online Password cracking with hydra, xhydra.
   b) Offline Password Cracking with John the ripper.
8. Wireless Network attacks:-
   a) Aircrack-NG.
   b) Fern Wi-Fi cracker
9. Burpsuit , OWASP ZAP tools
10. DOS attack, Sql-injection, XSS attack.
11. Phishing attacks with Setoolkit.

References :

1. Basic Security Testing with Kali Linux -Daniel W. Dieterle
2. Hacking exposed web applications - JOEL SCAMBRAY MIKE SHEMA

Big Data Analytics Lab

(Job Oriented Elective Lab – 3)

IV B. Tech. – VII Semester (Code: 20DSL702/JOL3C)

Lectures:	0 Hours/week	Tutorial:	0 Hours/week	Practical:	3 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	1.5

Pre-Requisite: Problem Solving using Programming (20DS203), Object Oriented Programming (20DS303), Database Management System(20DS403)

Course Objectives: Students will be able to

- Understanding Big data, Hadoop and Hadoop Distributed File System.
- Understanding YARN(Yet Another Resource Node), Map Reduce mechanism.
- Understanding PIG, HIVE.
- Understanding SQOOP, SPARK.

Course Outcomes: Students will be able to

CO1 Understand the concepts of Data mining and Big Data Analytics
CO2 Apply machine learning algorithms for data analytics
CO3 Analyze various text categorization algorithms
CO4 Use Technology and tools to solve the Big Data Analytics problems

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	3	-	-	2	-	2	-	3	3	3	3
CO2	3	3	3	3	3	-	-	2	-	2	-	3	3	3	3
CO3	3	3	3	3	3	-	-	2	-	2	-	3	3	3	3
CO4	3	3	3	3	3	-	-	2	-	2	-	3	3	3	3

List of Experiments

1. Write the steps for installation of Hadoop.
2. Write commands to interact with HDFS interface.
3. Write a Map Reduce program for Word Count Example.
4. Write a Map Reduce program for Card Count data set.
5. Write the steps for installation of Pig.
6. Write the word count script using Pig Latin.
7. Illustrate the basic Pig Latin concepts with help of any dataset.
8. Write the steps for installing Hive.
9. Illustrate the creation, loading & complete select statements in Hive.
10. Write the script how data will be transfer using Sqoop.

Text Books :

1. HADOOP "The Definitive Guide", Tom White, O'Reilly Publications, 4th Edition.
2. Black Book on Big Data, Dreamtech Publications.

References :

1. Hadoop in Action, Hadoop Beginner's Guide,Optimizing Hadoop for MapReduce, Scaling Big Data with Hadoop and Solr

Industrial/Research Internship

IV B.Tech – VII Semester (Code: 20DSL703/INT02)

Lectures:	0 Hours/week	Tutorial:	0 Hours/week	Practical:	0 Hours/week
CIE Marks:	00	SEE Marks:	100	Credits:	3.0

Pre-Requisite: None.

Course Objectives: To make the students

- To enable students to apply academic concepts to practical, real-world computer science problems.
- To cultivate essential professional competencies, including teamwork, communication, critical thinking, problem-solving, and time management.
- To provide a realistic understanding of industry practices, work culture, and the day-to-day operations of a technology company.
- To expose students to ethical considerations and professional conduct in a corporate setting.

Course Outcomes: At the end of the course, students will be able to

CO1	To apply and adapt industry knowledge to solve practical problems in a professional setting.
CO2	Demonstrate improved teamwork, communication, problem-solving, and time management skills.
CO3	Build a professional network by interacting with industry professionals and peers.
CO4	Real projects to add to their portfolio, providing tangible evidence of their abilities.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	2	2	-	2	2	3	3	-	3	3	2	2
CO2	3	3	2	2	2	-	2	2	3	3	-	3	3	2	2
CO3	3	3	2	2	2	-	2	2	3	3	-	3	3	2	2
CO4	3	3	2	2	2	-	2	2	3	3	-	3	3	2	2

Guidelines and Evaluation of Internship Program

As per R20 guidelines, every student has to undergo internship twice, once between IV and V semester, the other between VI and VII Semester. The first internship is for duration of 4 weeks and the second internship is for duration of 6 weeks.

There shall be a departmental internship committee consisting of the Head of the Department and two faculty members nominated by the HOD. The committee shall identify the potential organizations which can provide internship opportunity to the students. The department shall enter into an MOU with the concerned organization and the details will be shared with the students.

The students shall be informed to apply for undergoing internship in the specified proforma. The details and consent of the organization in which he/she is seeking for internship are to be furnished. Further, the student along with the parent must submit an undertaking form. The committee shall scrutinize the applications and approve the same. If a student fails to acquire internship, he/she may be permitted to undergo equivalent work (mini project, research project, fabrication work, field work, research paper, etc.,) in the department under the guidance of a faculty member.

After the completion of the internship, the student must submit the report and attend a departmental internal assessment for award of grade and credits.

Weightage for Evaluation: The various stages of evaluation and weightage at each stage are given below.

Stage	Marks	Remarks
Internship Certificate	20M	Company Supervisor will assess the interns in the internship company premises. Company supervisor assesses the intern and provide certificate
Report Submission	30M	After the completion of the internship, the student must submit the report along with certificate.
Final Assessment – in the college premises	50M	The HOD of the concern department acts as convener of the committee and two faulty members are members to assess the intern's performance

Project Work & Internship

IV B.Tech – VIII Semester (Code: 20DS801/PW01)

Lectures:	0 Hours/week	Tutorial:	0 Hours/week	Practical:	24 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	12

Pre-Requisite: None.

Course Objectives: At the end of the course, students will be able to

- To apply core computing concepts and engineering principles in developing practical software or hardware solutions.
- To enhance problem-solving, analytical, and design skills through real-world project implementation.
- To foster teamwork, communication, and project management abilities in a professional environment.
- To evaluate and document project outcomes with emphasis on innovation, quality, and societal relevance.

Course Outcomes: At the end of the course, students will be able to

CO1 Apply the domain knowledge to provide solution for the real time problems. Acquire the tools & techniques of project implementation and to get an exposure to handle projects.

CO2 Prepare the plan to handle project. Apply advanced software tools to analyze the project execution.

CO3 Improve the presentation and documentation writing skills. Apply an insight into modern technologies, tools to get the results for the real-world problems.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	3	3	3	3	3	3	-	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	-	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	-	3	3	3	3

Project Work Guide Lines

The Project work shall be carried out by a batch consisting not more than four students for one semester. It should help the students to comprehend and apply different theories and technologies that they have learnt through and are learning. It should lead to a substantial result as a comparative study, a new application of the technologies available or some extension to the works carried out by some researcher and published in referred journals. Each batch must carry out the analysis, design, implementation and testing of the entire project basing on the Software Engineering principles. There shall be a total of four reviews made by the batch regarding:

1. 0^{th} Review: The idea/concept which forms the basis for their project shall be presented to the guide, concerned in charge and classmates and shall get the approval for Continuation.
2. 1^{st} Review: The analysis and design carried out.
3. 2^{nd} Review: The implementation and the testing done.
4. 3^{rd} Review: Over all Presentation of the work carried out and the results found out for the valuation under the internal Assessment.

A comprehensive report on the lines of IEEE Format is to be submitted at the end of the semester, which is certified by the concerned guide and the HOD.
There shall be an external guide appointed by the Principal/Controller of Examiner to make an assessment and to carry out the Viva-Voce examination

List of HONOR Courses

Code	Name of the Course	Mode
A	Advanced Data Structures	Class Room
B	Advanced Computer Architecture	Class Room
C	Prompt Engineering & AI Tools	Class Room
D	Advanced Database Management Systems	Class Room
E	Real Time Operating Systems	Class Room
F	Advanced Computer Networks	Class Room
G	Applied Cryptography	Class Room
H	Software Project Management	Class Room
I	Numerical Optimization	Class Room
J	Web Semantics	Class Room
K	Spatial Informatics	MOOC
L	Reinforcement Learning	MOOC
M	Virtual Reality	MOOC
N	Cloud Computing	MOOC
O	Computational Complexity	MOOC
P	Competitive Programming	MOOC
Q	Affective Computing	MOOC
R	Computer Vision and Image Processing	MOOC
S	Social Networks	MOOC
T	Ethical Hacking	MOOC

Advanced Data Structures

Honor Course (Code: A)

Lectures:	3 Hours/week	Tutorial:	1 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	4

Pre-Requisite: Data Structures

UNIT-1 16 Hours

Efficient Binary Search Trees: - Red-Black Trees, Splay Trees, 2-3 Trees – Properties, Rotations, Insertion, Deletion.

UNIT-2 16 Hours

Advanced Hashing: - Double Hashing, Rehashing, Extendible Hashing.

Priority Queues: - Binomial heaps, Symmetric Min-Max Heaps, Fibonacci Heaps – Structure of Fibonacci heaps, Mergeable-heap operations, decreasing a key and deleting a node, Bounding the maximum degree.

UNIT-3 16 Hours

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries. Data Structures for Disjoint Set: - Disjoint-set operations, Linked-list representation of disjoint sets, Disjoint-set forests, Analysis of union by rank with path compression.

UNIT-4 16 Hours

String Matching: - The naive string-matching algorithm, The Rabin-Karp algorithm, The Knuth-Morris-Pratt algorithm.

Text Books : 1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education.
2. Cormen, Leiserson, Rivest and Stein, "Introduction of Computer Algorithm", PHI.

References : 1. Langsam, Augeustein and Tenenbaum, "Data Structures Using C", Pearson Education Asia.
2. Horowitz, Sahniand, Rajasekaran,"Fundamentals of Computer Algorithms", Galgotia Publication.

Advanced Computer Architecture

Honor Course (Code: B)

Lectures:	3 Hours/week	Tutorial:	1 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	4

Pre-Requisite: Computer Origination

UNIT-1 16 Hours

Parallel Computer Models: The state of computing, Classification of parallel computers, Multiprocessors and Multi computers, Multi-vector and SIMD computers.

Program and network properties: Conditions of parallelism, Data and resource Dependencies, Hardware and Software parallelism, Program partitioning and scheduling, Grain Size and latency, Program flow mechanisms, Control flow versus data flow, Data flow Architecture, Demand driven mechanisms, Comparisons of flow mechanisms.

System Interconnect Architectures: Network properties and routing, Static interconnection Networks, Dynamic interconnection Networks, Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network.

UNIT-2 16 Hours

Principles of Scalable Performance: Performance Metrics and Measures: Parallelism Profile in Programs, Efficiency, Utilization and Quality, Standard Performance Measures, Speedup

Performance Laws: Amdahl's law for fixed load, Gustafson's law for scaled problems, Memory Bounded Speedup Model.

Pipelining: Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design-Instruction Execution Phases, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, Arithmetic Pipeline Design: Computer Arithmetic principles, Static Arithmetic pipeline, Multifunctional arithmetic pipelines.

UNIT-3 16 Hours

MULTI Processors: Multiprocessor System Interconnect: Hierarchical Bus Systems, Crossbar Switch and Multiport Memory, Multistage and Combining Networks, Cache Coherence and Synchronization Mechanisms: The Cache Coherence problem, Snoopy Bus Protocols, Directory Based Protocols, Hardware Synchronization Mechanisms, Message-passing Mechanism: Message Routing Schemes, Deadlock and Virtual Channels, Flow Control Strategies, Multicast Routing Algorithms.

Scalable, Multithreaded and Dataflow Architectures: Latency-Hiding Techniques, Principles of Multithreading, Scalable and Multithreaded Architectures.

UNIT-4 16 Hours

Thread Based Parallelism: Introduction, Using the python threading model, How to define a Thread, How to determine a current Thread, How to use a thread in subclass, Thread Synchronization with Lock and RLock, Thread Synchronization with RLock, Thread Synchronization with Semaphores, Thread Synchronization with a Condition, Thread Synchronization with an Event, Using a with Statement, Thread Communication with a Queue, Evaluating the performance of Multithreaded applications.

Process Based Parallelism: Introduction, How to spawn a process, How to name a Process, How to run a Process in the background, How to kill a process, How to use a process in subclass, how to exchange objects between processes, How to synchronize the Processes, How to manage a state between Processes, How to use a Process pool, Using the mpi4py python module, Point-to-Point to Communications, Avoiding Deadlock problems, Collective communication using

Broadcast, Collective Communication using a Scatter, Collective Communication using Gather, Collective Communication using All to all, The reduce operation, How to Optimize an Operation.

Text Books : 1. Kai Hwang, "Advanced Computer Architecture", TMH.
2. "Python Parallel Programming cookbook", Giancarlo Zaccone, Packt Publishing.

References : 1. D.A. Patterson and J.L.Hennessy, "Computer organization and Design", Morgan Kaufmann, 2nd Edition.
2. V.Rajaram & C.S.R.Murthy, "Parallel Computer", PHI.
3. Barry Wilkinson and Michael Allen, "Parallel Programming", Pearson Education.
4. Parallel Programming with Python, Jan Palach, Packt Publishing

Prompt Engineering & AI Tools

Honor Course (Code: C)

Lectures:	3 Hours/week	Tutorial:	1 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	4

Pre-Requisite: Machine Learning

UNIT-1 16 Hours

Introduction - Conversational Interfaces, Getting Set Up ChatGPT, How Does ChatGPT Sound Human.

Tools & Techniques - Conversational Approach to ChatGPT, Time for Roleplay with ChatGPT, Training ChatGPT, Chunking in ChatGPT.

UNIT-2 16 Hours

Advanced Prompt Engineering - Co-Creation with ChatGPT, [Format] Your Output in ChatGPT, Building Personas, Chain Prompting, The Rise of Autonomous Agents, Using ChatGPT without using ChatGPT.

GPT-4 - Getting Access to GPT-4, The Hype Was Wrong, More Context = More Power, Multimodal - Image Input, More Accurate, But Still Probabilistic, Web Browsing, ChatGPT Plugins.

UNIT-3 16 Hours

Use Cases - Brainstorming Ideas, Translations, Summarizing, Writing Articles, Blogs, and Books, Academic Writing, Emails, Learning to Codes, Finding Recipes, Having Fun.

UNIT-4 16 Hours

ChatGPT with Excel - Formula Writing, Formula Explanation, Formula Examples With Data, Formula Debugging, Complex Excel Formula Help, Formula Help – Using Data, Power Query – How to consolidate two sheets in Excel, ChatGPT & Sample Excel Data, ChatGPT & Excel Pivot Tables, AI Excel Formula Bot, ChatGPT & VBA Macros, ChatGPT & Excel Shortcuts.

ChatGPT for Microsoft Word - Benefits of using ChatGPT in MS Word, How to Use ChatGPT in Microsoft Word, VBA Code to Integrate ChatGPT with MS Word, How to fine tune ChatGPT Output, Steps for troubleshooting errors.

Text Books :

1. The Art of Prompt Engineering with ChatGPT by Nathan Hunter.
2. AI Prompt Engineering: The Engineer's Handbook, by Timothy Krimmel.
3. https://www.promptingguide.ai/
4. https://www.myexcelonline.com/blog/how-to-use-chatgpt-with-microsoft-excel-the-ultimate-guide/https://www.listendata.com/2023/05/integrate-chatgpt-into-word.html

Advanced Database Management Systems

Honor Course (Code: D)

Lectures:	3 Hours/week	Tutorial:	1 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	4

Pre-Requisite: Database Management Systems

UNIT-1 16 Hours

Introduction to NoSQL: Difference between RDBMS and NoSQLDatabase, Definition of NoSQL, History of NoSQL, NoSQL Storage Architecture, Types of NoSQL databases-Document Databases, Key-value databases, Column Oriented databases, Graph databases, When to use NoSQL and when not, Interfacing and Interacting with NoSQL.

UNIT-2 16 Hours

Introduction MongoDB: MongoDB installation, Basics of MongoDB, MongoDB shell, MongoDB datatypes, MongoDB CRUD operations: adding new documents to a collection, selecting documents, updating existing documents, removing documents from a collection.

UNIT-3 16 Hours

MongoDb Aggregation frameworks and MongoDb Aggregation operations: $group, $limit, $project, $sort, $match, $add fields, $count, $lookup, $out operators. MongoDb sorting, MongoDb indexing: single field indexes, sorting with indexed, compound indexed, partial indexes.

UNIT-4 16 Hours

MongoDb import and export, sharding in MongoDb, MongoDb python drivers, python and MongoDb, creating application with python and MongoDb.

Text Books :
1. MongoDB – The Definitive Guide, 2nd edition, Oreilly.
2. Pramod J.Sadalage, Martin Fowler, ”NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence”, 1st edition, Pearson Education, 2012.

References :
1. MongoDB Cook Book, 2nd edition, Cyrus Dasadia & Amol Nayak, PACKT Publishing.
2. Dan Sullivan, “NoSQL for Mere Mortals”, 1st edition, Pearson Education, 2015.

Real Time Operating Systems

Honor Course (Code: E)

Lectures:	3 Hours/week	Tutorial:	1 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	4

Pre-Requisite: Operating Systems

UNIT-1 16 Hours

Introduction: Typical Real-Time applications, Hard versus Soft Real-Time systems, A reference model of Real-Time Systems.

UNIT-2 16 Hours

Commonly used approaches to Real-Time scheduling: Clock-Driven scheduling, Pros and Cons of Clock-driven scheduling.

UNIT-3 16 Hours

Priority-Driven scheduling of Periodic tasks: static assumption, Fixed-Priority versus Dynamic-Priority algorithms, Optimality of the RM and DM algorithms, A schedulability test for Fixed-Priority tasks with short response times and arbitrary response times, sufficient schedulability conditions for the RM and DM algorithms;

Scheduling Aperiodic and Sporadic jobs in priority-Driven systems: Deferrable Servers, Sporadic Servers, Constant Utilization, Total Bandwidth and weighted Fair-Queuing Servers, Scheduling of sporadic Jobs.

UNIT-4 16 Hours

Resources and Resources Access Control: Scheduling Flexible computations and tasks with temporal distance constraints.

Text Books : 1. Jane W.S.Liu, “Real-Time Systems”, Pearson Education Asia.

References : 1. C.M.Krishna and G.Shin, “Real-Time Systems”, Tata McGraw Hill Co. Inc., 1997.

Advanced Computer Networks

Honor Course (Code: F)

Lectures:	3 Hours/week	Tutorial:	1 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	4

Pre-Requisite: Computer Networks

UNIT-1 16 Hours

Overview of data communication model – Internet Multicasting, NAT, VPN – Routing Algorithms – BGP, RIP, OSPF – Differentiated and Integrated Services – SONET, ATM – MPLS -Next generation Internet architectures, Green Communication Networks, and Data Center Networking.

UNIT-2 16 Hours

Analysis of Network congestion Mechanism - Routing algorithms, ARQ protocols Multimedia Networking; Implementation of multi-threaded Web Server/Web Proxy with Caching/Filtering features, Sliding Window protocol implementation, performance study of various TCP/IP variants.

UNIT-3 16 Hours

Software Defined Network - Comparison between SDN and traditional networks -SDN controller, Switch design, SDN Controller-Switch Protocols, Open Flow Protocol, Control Overhead & Handoff algorithms.

UNIT-4 16 Hours

Network Function Virtualization - NFV Architecture, Use cases, NFV Orchestration and NFV for 5G.

Text Books :

1. Tanenbaum AS, Wetherall DJ. Computer Networks. Fifth edition, Pearson Education, Inc. 2011.

References :

1. Stallings W. Data and Computer Communications. Pearson Education India; 2006.
2. Douglas E Comer. Internet Working with TCP/IP Volume -1, Sixth Edition, Addison-Wesley Professional;2013.
3. Goransson P, Black C, Culver T. Software Defined Networks: a Comprehensive Approach. Morgan Kaufmann; 2014.
4. Chayapathi R, Hassan SF, Shah P. Network Functions Virtualization (NFV) with a Touch of SDN: Netw Fun Vir (NFV ePub_1. Addison-Wesley Professional; 2016 Nov 14.
5. Marschke D, Doyle J, Moyer P. Software Defined Networking (SDN): Anatomy of OpenFlow Volume 1. 2015.

Applied Cryptography

Honor Course (Code: G)

Lectures:	3 Hours/week	Tutorial:	1 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	4

Pre-Requisite: Cryptography & Network Security

UNIT-1 16 Hours

Protocol Building Blocks - Basic Protocols - Advanced Protocols: Zero-Knowledge Proofs - Zero-Knowledge Proofs of Identity -Blind Signatures - Identity-Based Public-Key Cryptography - Oblivious Transfer - Oblivious Signatures - Esoteric Protocols.

UNIT-2 16 Hours

Key Length - Key Management – Algorithm Types and Modes: Electronic Codebook Mode - Block Replay - Cipher Block Chaining Mode - Stream Ciphers - Self-Synchronizing Stream Ciphers - Cipher-Feedback Mode - Synchronous Stream Ciphers - Output-Feedback Mode - Counter Mode - Choosing a Cipher Mode - Interleaving - Block Ciphers versus Stream Ciphers – Using Algorithms: Choosing an Algorithm – Public Key Cryptography versus Symmetric Cryptography - Encrypting Communications Channels - Encrypting Data for Storage - Hardware Encryption versus Software Encryption - Compression, Encoding, and Encryption - Detecting Encryption – Hiding and Destroying Information.

UNIT-3 16 Hours

Mathematical Background: Information Theory - Complexity Theory - Number Theory - Factoring - Prime Number Generation – Discrete Logarithms in a Finite Field – Other Block Ciphers: Lucifer -Madryga - NewDES - GOST – 3 Way – Crab – RC5 – Combining Block Ciphers: Double Encryption - Triple Encryption - CDMF Key Shortening - Whitening.

UNIT-4 16 Hours

Pseudo-Random-Sequence Generators and Stream Ciphers – Other Stream Ciphers and Real Random-Sequence Generators: RC4 - SEAL - Feedback with Carry Shift Registers - Stream Ciphers Using FCSRs - Nonlinear-Feedback Shift Registers - System-Theoretic Approach to Stream-Cipher Design - Complexity-Theoretic Approach to Stream-Cipher Design – One-Way Hash Functions: N- Hash - MD4 - MD5 - MD2 - Secure Hash Algorithm (SHA) - OneWay Hash Functions Using Symmetric Block Algorithms - Using Public-Key Algorithms - Message Authentication Codes.

Text Books :

1. Bruce Schneier, “Applied Cryptography: Protocols, Algorithms, and Source Code in C” John Wiley & Sons, Inc, 2nd Edition, 1996.

References :

1. William Stallings, “Cryptography and Network Security, Prentice Hall, New Delhi, 2006.
2. Bernard Menezes, “Network Security and Cryptography”, Cengage Learning, New Delhi, 2010.

Software Project Management

Honor Course (Code: H)

Lectures:	3 Hours/week	Tutorial:	1 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	4

Pre-Requisite: Software Engineering

UNIT-1 16 Hours

Conventional Software Management: The waterfall model, conventional software Management performance.

Evolution of Software Economics: Software Economics, pragmatic software cost estimation.

Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.

The old way and the new: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

UNIT-2 16 Hours

Life cycle phases: Engineering and production stages, inception, Elaboration, construction, transition phases.

Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

Model based software architectures: A Management perspective and technical perspective.

Work Flows of the process: Software process workflows, Iteration workflows.

UNIT-3 16 Hours

Checkpoints of the process: Major mile stones, Minor Milestones, Periodic status assessments. Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations.

Process Automation: Automation Building blocks, The Project Environment.

UNIT-4 16 Hours

Project Control and Process instrumentation: The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation.

Tailoring the Process: Process discriminants.

Future Software Project Management: Modern Project Profiles, Next generation Software economics, modern process transitions.

Case Study: The command Center Processing and Display system- Replacement (CCPDS-R)

Text Books :

1. Software Project Management, Walker Royce: Pearson Education, 2005.

References :

1. Software Project Management, Bob Hughes and Mike Cotterell: Tata McGraw-Hill Edition.
2. Software Project Management, Joel Henry, Pearson Education.
3. Software Project Management in practice, Pankaj Jalote, Pearson Education.

Numerical Optimization

Honor Course (Code: I)

Lectures:	3 Hours/week	Tutorial:	1 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	4

Pre-Requisite: Mathematics

UNIT-1 16 Hours

Linear Programming Problem: Introduction; Graphical Solution Method; Some exception cases; General Linear Programming Problem; Canonical and Standard Forms of L.P.P; The Simplex Method: Introduction, Fundamental Properties of Solutions(without Proofs); the Computations Procedure, Artificial Variable Techniques(Big-M method), Problem of Degeneracy. [Sections:2.1;2.3;2.4;2.5;2.6;3.1;3.2;3.3;3.5;3.6]

UNIT-2 16 Hours

Games and Strategies: Introduction; Two-person Zero–Sum Games; The Maximin- Minimax Principle; Games Without Saddle Points-Mixed Strategies; Solution of 2x2 Rectangular Games; Graphical Method; Dominance Property; Algebraic Method for mxn Games; Limitations and Extensions. [Sections:9.1;9.2;9.3;9.4;9.5;9.6;9.7;9.8;9.12]

UNIT-3 16 Hours

Integer Programming Problem: Introduction, Gomory's All-Integer Programming Problem Method; Branch and Bound Method.

Dynamic Programming: Introduction, the Recursive Equation Approach, Characteristics of Dynamic Programming, Dynamic Programming Algorithm, Solution of Discrete Dynamic Programming Problem. [Sections:11.1;11.2;11.4;12.1;12.2;12.3;12.4;12.5]

UNIT-4 16 Hours

Queuing Theory: Introduction, Queuing System, Characteristic of Queuing System, Symbols and Notations, Poisson Process and Exponential Distribution, Classification of Queues, Definition of Transient and Steady States, Poisson Queues; The M/M/I Queuing System: Model-I (M/M/I): (∞/FIFO) , Model-II (M/M/I): (∞/ SIFO) , Model-III (M/M/I):(N/FIFO), Model-IV(Birth-Death Process). [Sections:17.1;17.2;17.3;17.4;17.5;17.6;17.7;17.8;17.8.1]

Text Books :

1. Kanthi Swarup, P.K Gupta &Man Mohan, 'Operations Research'

References :

1. SD.Sharma, "Operations Research", Kedarnath, Ramnath &Co.,
2. Hamdy A.Taha, Operations Research: An introduction, Pearson Prentice Hall, New Jersey.

Web Semantics

Honor Course (Code: J)

Lectures:	3 Hours/week	Tutorial:	1 Hours/week	Practical:	0 Hours/week
CIE Marks:	30	SEE Marks:	70	Credits:	4

Pre-Requisite: Web Technology

UNIT-I 16 Hours

The Semantic Web Vision, Today's Web, Semantic Web Technologies, A Layered Approach Structured Web Documents in XML, Motivation and Overview, the XML Language Structuring, DTDs, XML Schema, Namespaces, Addressing and Querying XML Documents Processing.

UNIT-2 16 Hours

Describing Web Resources in RDF, Motivation and Overview, RDF: Basic Ideas, RDF: XML-Based Syntax RDF Schema: Basic Ideas, RDF Schema: The Language, RDF and RDF Schema in RDF Schema, An Axiomatic Semantics for RDF and RDF Schema, RDF,RDF Schema A direct inference system for RDF(S) Querying in RQL.

Web Ontology Language: OWL, Motivation and Overview, the OWL Language, Examples An African Wildlife Ontology, printer ontology, OWL in OWL, Future extensions.

UNIT-3 16 Hours

Logic and Inference: Rules , Motivation and Overview , An Example of Monotonic Rules: Family Relations , Monotonic Rules: Syntax , Monotonic Rules: Semantics , Nonmonotonic Rules: Motivation and Syntax , An Example of Nonmonotonic Rules: Brokered Trade , Rule **Mark-up in XML:** Monotonic Rules Rule Mark-up in XML: Nonmonotonic Rule

Applications: Introduction, Horizontal information products from Elsevier, Data integration at Boeing (and elsewhere), Skill-finding at Swiss Life , Think-tank portal at Ener Search, eLearning, Web Services ,Other applications scenarios.

UNIT-4 16 Hours

Ontology Engineering: Introduction, Manually constructing ontologies, Re-using existing ontologies Using semi-automatic methods, On-To-Knowledge Semantic Web architecture.

Text Books :

1. "A Semantic Web Primer", Grigoris Antoniou,Frank van Harmelen, The MIT Press,Cambridge, Massachusetts ,London, England.

References :

1. "Foundations of Semantic Web Technologies"by Markus Krotzsch , Pascal Hitzler , Sebastian Rudolph